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ABSTRACT

This teachers' resource guide contains four sections in addition to an introduction. The first section is an interdisciplinary look at the major natural areas in and around Albuquerque. This is followed by a review of the city's cultural history and a glimpse into the interactions people of Albuquerque have had with their natural environment. The third section views the students' own school as a city in microcosm and presents the concept of an environment as an abiotic-biotic-cultural interrelated triangle. The last section looks at the environmental concerns of Albuquerque. Each section contains suggested activities which integrate various subject areas and are adaptable to various grade levels. (BB)

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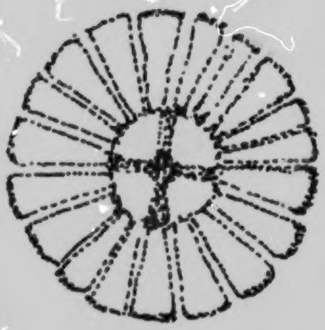
Albuquerque's Environmental Story

W. Aeschliman

SE 026 989



Credo

I believe that the school in its entirety and the world beyond it are the classroom which most effectively provides the education my students and our society deserve;

And, I believe that it is my role to establish a learning climate in which my students can acquire not only basic, measureable skills and knowledge, but also the less easily measured but equally important critical judgment and environmental concern so necessary for responsible citizenship;

Finally, I believe that the survival of mankind depends on the emergence of a new generation educated to question its attitudes and values, to respect and protect diversity wherever it occurs in natural and human communities, and to modify its behavior in conformity with an ethic which sees people as *part* of the natural world — not its masters.

An APS Teacher

Albuquerque's Environmental Story

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Foreword

Many successful projects come about because of a fortunate coincidence, and the environmental guidebook for Albuquerque's teachers is one such happy "marriage of concerns." The Planning Department gets many requests from teachers for materials on urban planning and environmental protection in addition to the many talks and presentations we make to school classes each year. As a result of these activities, we were acutely aware of the need for concise, education-oriented materials on Albuquerque's environment when Hy and Joan Rosner brought to the Department the idea of preparing *Albuquerque's Environmental Story*. After discussion with Albuquerque Public Schools, we learned that APS also was aware of such a need, and this jointly sponsored guidebook is the product of that shared concern. We hope that local educators will find the book useful in their valiant attempt to continually build on the environmental education curriculum.

Our message in this book is very simple and very clear: each of us has both the opportunity and the responsibility, as Pericles said, "to transmit this city not less but better and more beautiful than it was transmitted to us." The cooperative nature of this project is proof that both the City of Albuquerque and the Albuquerque Public Schools believe in the promise of the future, and that especially our children, informed and committed to planning for the future, can make that promise a reality.

Many people have given generously of their time and talent in the preparation of this book, and each of them has our sincere appreciation. If the foothills, volcanoes, and bosque could speak from their ancient desire to be understood by all who live here, they undoubtedly would nominate Hy and Joan Rosner for sainthood for devoting two years of their lives to this book; but if just one student is inspired by this work, we know the Rosners will think that is reward enough. Ralph Dixon, Bill Nabors, and John Cox have been the standard bearers at APS, and their support and encouragement is appreciated.

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To The Teacher

Albuquerque's Environmental Story was designed as a guide to Albuquerque's natural and human systems — past, present, and future. It is intended to serve as a companion to the many curricula used by Albuquerque teachers in all grades from kindergarten through high school. A basic premise underlying the planning and preparation of this book is that environmental studies is not a separate curriculum area, but can and should be infused into most of the subjects taught in Albuquerque Public Schools.

A primary objective of the book is that it enables teachers to view the city's environment and the students who live and participate in it as interreacting parts of a natural, and human, system.

Unfortunately, without excessive repetition, printed material cannot convey complex interrelationships as effectively as the mind can perceive them. Thus, to organize and write the book required that facets of the total environment and of the total student frequently be dealt with apart from the larger context of systems. However, it is expected that the book, in its totality, will represent these numerous facets of human beings and their environment as the interdependent entities they really are.

For ease of use, informational and descriptive background material are printed on the blue pages. Suggested activities for infusing the environmental concepts and learnings of this book into the Albuquerque Public School's curricula are printed on the white pages. It should be noted that the blue pages contain information offered in both narrative and reference format, the latter to be used selectively, as needed. For the teacher's convenience, this book was designed to collect and present the broadest possible range of background material in one comparatively brief volume.

The book contains four sections in addition to an INTRODUCTION which presents an overview of contemporary Albuquerque . . . where it came from, and where it might be heading. The first section is an interdisciplinary look at the major natural areas in and around the city (ALBUQUERQUE'S NATURAL ECOSYSTEMS). This is followed by a review of the city's cultural history and a glimpse into the interactions people of Albuquerque have had with their natural environment (ALBUQUERQUE'S HERITAGE AND HUMAN ENVIRONMENT). The third section views the students' own school as a city in microcosm — a mini-environment — and presents the concept of an environment as an abiotic/biotic/cultural interrelated triangle (THE SCHOOL AND ITS COMMUNITY). Finally, the last section looks at the environmental concerns of Albuquerque, and examines planning as a constructive link between the present and the future (ALBUQUERQUE TODAY AND TOMORROW).

Albuquerque's Environmental Story is a teachers' resource book, not a curriculum. Teachers are encouraged to use any parts of it which meet the needs of their students and their own curriculum plans. No special sequence is recommended. Some teachers may select to start with, or concentrate on, Section III (THE SCHOOL AND ITS COMMUNITY). Others may prefer to emphasize human systems and the city's environmental topics of concern. Some may consider it logical to develop an understanding of the natural environment in which the city is located before exploring man's interactive role in its history and future.

The purpose of the activities in each section is not to present lesson plans, but rather it is to relate the thrust of this resource book to the existing APS curricula. The skill subjects (reading, mathematics, and language arts) are integrated throughout the book without reference to grade level. Similarly, the affective domain is considered in an ungraded way through topics suggested under the heading of, "Activities For The Senses and Sensibilities." The aim of these activities is to nurture the sense of wonder found in most young people, to foster sensory and emotional responses to the beauties of the environment, and to suggest satisfying, creative ways of expressing these feelings.

Activity references on each page entitled SUGGESTED INFUSABLE AREAS . . . are included to help teachers see relationships between the content of their curricula and the book. Teaching strategies explicit in the activities were not designed for any particular grade, and should lend themselves to adaptation by teachers to the maturity levels of a variety of grades. Thus, Eye-Opener Activity #4, p. 25 is listed as adaptable to Grades 1, 4, 5, 6, Middle School Science, High School Biology, Environmental Science, and Consumer Biology. The content of the activity and the questions which grow out of it have a relationship to some part of the content of each of the curricula noted. The activity, as stated, "Using words or diagrams, explain how a forest animal gets water; how a desert animal gets water," and the questions about adaptations for survival in different habitats, about problems connected with raising non-indigenous plants, and about how humans could get water for themselves in a forest or desert — all would require some modification at the various grade levels indicated. (The elementary science curriculum topics listed in the SUGGESTED INFUSABLE AREAS . . . are references to SCIS, the *Science Curriculum Improvement Study* materials used in some of the schools. Also, a number of the high school references are to programs or electives which are offered as described at some high schools, under slightly varying titles at others, or not at all in some instances.)

The Activities in each section include non-graded Eye-Opener Worksheets which direct students' attention to some aspect of their environment with which they are probably familiar, but have not focused on before. These sheets are designed to be duplicated for distribution to your students. The Eye-Opener Activities following the Worksheets suggest opportunities for a more in-depth examination of the subject.

The bulleted questions included in each activity have one or more uses. Sometimes the questions are developed sequentially as they would be in a lesson (Activity #13, p. 28). Sometimes they represent approaches to different grades or maturity levels (Activity #5, p. 46). Some questions stem from the basic activity but point the way toward other ideas which can form subsequent lessons or series of lessons (Activity #30, p. 98). Finally, some of the questions could serve as a basis for independent projects to be conducted by individual students or groups of students, as in the elementary school open classroom or a high school special program (Activity #6, p. 63).

Words printed in bold type are defined in the glossary.

If *Albuquerque's Environmental Story* succeeds in its mission, students will develop both the insight and the problem-solving skills which will help them acquire the specific knowledge necessary for environmental decisionmaking. They will also question their values and modify their attitudes, and will translate this heightened appreciation of their environment into responsible citizen action. The authors especially hope that students using the activities in this book will learn to include people — themselves and others — in their concept of "the environment," and that they will grow in their ability to live in closer harmony with their human and natural surroundings. Of equal importance is the authors' hope that the most refreshing and natural characteristic of children, their sense of wonder, be nurtured so that it remains a stimulus to learning throughout their lives.

ENVIRONMENTAL UNDERSTANDINGS

BASIC CONCEPTS

1. The basic function of any ecosystem is to capture and transfer energy.
2. The Earth's main source of energy is the sun.
3. Energy is initially supplied to an ecosystem by the activities of green plants.
4. Diversity is a key factor in the survival of an ecosystem.
5. The energy requirements of man are met primarily by "food," and men are dependent upon other organisms through food chains and food webs.
6. Living things are interdependent with one another and with their environment.
7. Any one of an environment's components, such as space, water, food, or energy, may become a limiting factor.
8. Organisms and environments are in constant change.
9. Survival of an organism depends upon its ability to adjust to its environment. Each kind of organism represents a collection of adaptations which fit it for survival under a given set of conditions.
10. Man changes the natural environment to the extent that many species find it difficult to adapt to the new conditions.
11. Land forms influence the type of community in which people live.

NATURAL RESOURCES

12. The material welfare and aspirations of a culture largely determine the use and management of natural resources.
13. Natural resources are interdependent and the use or misuse of one will affect others.
14. Raw materials and energy supplies are generally obtained from those resources available at least cost, with supply and demand determining their economic value.
15. Social, economic, and technological changes affect the interrelationships of quality, availability, and the use of natural resources.
16. As natural resources become more scarce, the inexhaustible supply of human energy, resolve, determination, and ingenuity must be fully utilized.
17. Plant and animal populations are renewable resources.
18. Water is a reusable and transient resource, but the usable quantity may be reduced by impaired quality.
19. Soil, trees, and water are classified as renewable resources, but, because their renewal or revitalization requires a major investment in time and effort, they may be more realistically considered depletable resources.
20. In nature, there is a continuous recycling of many elements.
21. Man would do well to observe nature's example and recycle the results of his technology.
22. Most resources are vulnerable to depletion in quantity and quality.
23. The nonrenewable resource base of mineral elements is considered finite, and depletion can only be slowed by altered priorities, new demographic considerations, improved conservation practices, and vigorous recycling procedures.
24. The rate of resource consumption increases in direct proportion to the expansion of our wants, needs, and markets.
25. Historically, cultures with high technological development have used disproportionately more natural resources than those with lower levels of technological development.

ENVIRONMENTAL ETHIC

26. Physical well being is a fundamental necessity for survival even though man often places a higher value on other things.
27. Social values and morals influence environmental attitudes. Mankind is continually developing an ethical base for making value judgments.
28. Ethically, we are stewards rather than owners of the resource base.
29. Man has exercised a presumed right to exploit the environment with little regard for his responsibility to preserve it.
30. Man currently faces the prospect of endangering his chances of a better life through the very measures he employs to achieve it.
31. The demands of population growth coupled with man's tremendous waste of energy are responsible for some of our more serious environmental problems.
32. Individuals should become well informed about the best ways to manage and conserve our energy supplies.
33. Choices between essential needs and nonessential desires are often in conflict.
34. Individuals tend to select short-term economic gains, often at the expense of greater long-term environmental benefits.
35. It is the responsibility of each individual to become aware of existing governmental regulations intended to protect the environment.
36. The arts seem to aid man in feeling a oneness with nature and with fellow men.

With permission from *Designing An Environmental Curriculum . . . A Process*, New York State Education Department, Albany, NY 1975.

ENVIRONMENTAL EDUCATION INSTRUCTIONAL OBJECTIVES

If our goal is to educate students to appreciate Albuquerque's unique natural and cultural heritage and to understand the need for effective participation in the social process which affects its future environment, then the student (according to his age and ability) should be able to:

In General . . .

1. . . . demonstrate a grasp of the principles and generalizations of an ecosystem.
2. . . . define and give examples in both natural and human ecosystems of the following terms: interrelationship; adaptation; succession; scarcity; survival; diversity; recycling.
3. . . . differentiate between renewable and nonrenewable resources.
4. . . . categorize the world's resources as renewable and nonrenewable.
5. . . . identify some renewable and nonrenewable resources in danger of depletion or extinction.
7. . . . identify and assess the impact of technology on the environment.
8. . . . critically examine the ecological implications of technological "advances" before endorsing them.
9. . . . relate consumption habits to resource depletion.
10. . . . recognize and describe the limits of the earth's energy resources.
11. . . . list and describe present and alternate sources of energy.
12. . . . make informed judgments on energy sources in terms of environmental impact.
13. . . . record, document, and report observations of environmental issues.
14. . . . recommend specific resource materials (books, magazines, governmental publications) for obtaining information about environmental issues.
15. . . . show that the natural world and human society are in a state of constant change; cite examples of such change.
16. . . . cite ways in which the people of Albuquerque and their physical environment are interrelated.
17. . . . explain the geological relationship between the Sandia Mountains and the rift in which most of Albuquerque is located.
18. . . . explain how the physical factors in Albuquerque's environment influenced its cultural history.
19. . . . explain how Albuquerque's cultural history influenced factors in its physical environment.
20. . . . contrast the impact upon Albuquerque's environment by peoples of other times with that of today.
21. . . . analyze the problems affecting Albuquerque's environment.
22. . . . list some of Albuquerque's most serious environmental problems.
23. . . . design and test hypotheses to explain environmental problems in this community.
24. . . . relate data from other disciplines to the subject area in which the environmental problem is studied.
25. . . . design a problem solving approach to one of Albuquerque's environmental issues.
26. . . . demonstrate an awareness of environmental problems facing the city by recognizing such in the community and by reacting to news items.

27. . . . develop a means to share environmental information with schoolmates, parents, and community.

28. . . . initiate or participate in action programs planned to counteract specific environmental problems in the school, neighborhood, or city/county.

29. . . . initiate letters to local officials and newspaper editors suggesting solutions for local environmental problems.

30. . . . defend and support with facts a position concerning possible solutions to an environmental problem concerning the school, neighborhood or city.

31. . . . attend, and present testimony at, a public hearing concerning an environmental issue (when possible).

32. . . . prepare simple questionnaires for gathering information about community reactions to local environmental problems.

Specifically . . .

33. . . . list, describe, and indicate the sources of Albuquerque's major air pollutants.

34. . . . cite some methods Albuquerque is using, or considering using, to recover, reuse, or recycle waste or unused materials.

35. . . . specify actions which could preclude the necessity to recover, reuse, or recycle wasted materials.

36. . . . Construct reusable items from discarded materials.

37. . . . cite ways to dispose of wastes in a manner that demonstrates an awareness of long-range consequences to the environment.

38. . . . express and defend an opinion concerning Albuquerque's future growth.

39. . . . express and defend an opinion concerning the city's physical appearance, its architectural heritage, its present architecture, and future building designs.

40. . . . locate on a map Albuquerque's publicly-owned open space, and indicate areas currently under consideration for public acquisition.

41. . . . express a knowledgeable position concerning current open space issues, and define that position.

42. . . . describe some of the local governmental processes which influence the quality of Albuquerque's environment.

and Finally . . .

45. . . . demonstrate through words or actions a heightened appreciation of Albuquerque's unique natural and cultural environment.

46. . . . refrain from abusing public parks and other areas.

47. . . . recognize visually attractive patterns in nature and utilize them as design for manmade products.

48. . . . demonstrate attitudinal change toward littering.

49. . . . demonstrate a willingness to forego enjoyable activities that adversely affect the environment.

50. . . . construct an "Environmental Bill of Rights" and an "Environmental Bill of Responsibilities."

> "There is only one subject matter for education and that is LIFE in all its manifestations."
>
> Alfred North Whitehead

Introduction

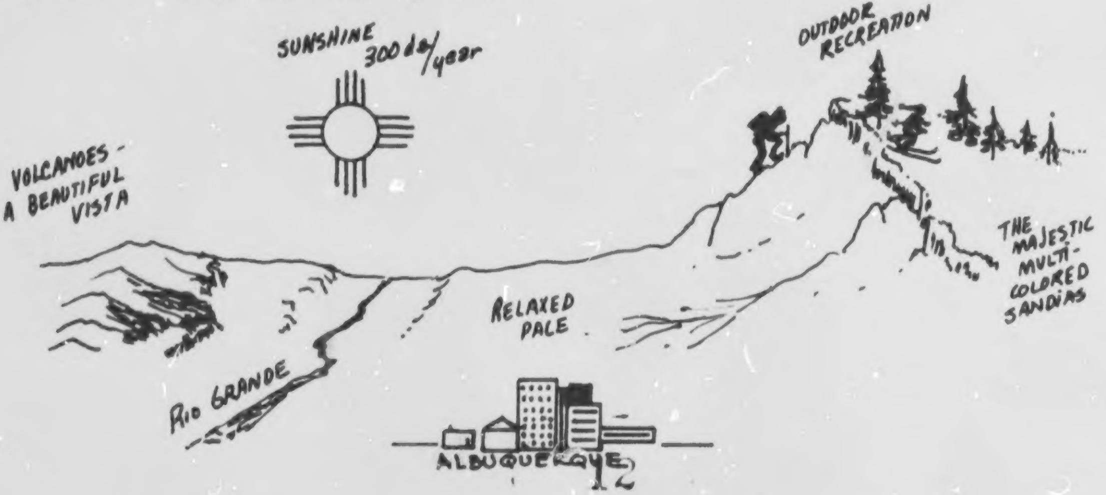
ALBUQUERQUE THEN AND NOW

WHY ALBUQUERQUE

Native Albuquerquean? Long-time resident? Recent transplant? Whichever category you belong to, you probably live in Albuquerque because you *really* want to. Most of us do. And our reasons for selecting it as a place to live are very similar.

Ernie Pyle, the noted journalist, wrote an article in January, 1942 for *New Mexico Magazine* as a response to a question often asked him: "With the whole of the United States to select from, why did you choose Albuquerque for your home?" Many Albuquerqueans can still identify with his answer.

> ". . . And here are the things we like about living in Albuquerque. . . We like it because our front yard stretches as far as you can see, and because old Mt. Taylor, 65 miles away, is like a framed picture in our front window. We like it because when we look to the westward we look clear over and above the city of Albuquerque and on beyond, it seems, halfway to the Pacific Ocean.
>
> We like it because you can cash a check in Albuquerque without being grilled as though you were a criminal. And because after your second trip to a filling station the gas-pumper calls you by name. We like it because people are friendly and interested in you, and yet they leave you alone. . . . And we like it here because you can do almost anything you want to, within reason. In four months I haven't been out of overalls more than half a dozen times.
>
> We like it because we can have Navajo rugs in our house, and pinon and juniper bushes in our yard, and western pictures on our knotty pine walls. We like it because you can take a Sunday afternoon spin into the mountains and see deer and wild turkey, and because I have a workbench where I make crude little end-tables and such stuff for our house.
>
> We like it because you aren't constantly covered with smoke and soot, and because the days are warm and the nights are cool. . . . We like it because we can see scores of miles in any direction from our house, and yet we can drive downtown in seven minutes. . . . We like it out here because we seem to go to bed early and get up early — and certainly out here he who does not see the dawn at least once a week is missing perhaps the loveliest thing the desert has in its Horn of Plenty. . . .
>
> We like it here because no more than half our friends who write us can spell Albuquerque. We like it here because there aren't any street cars, and because you see lots of men on Central Avenue in cowboy boots. We like it because you can see Indians making silver jewelry, and you can see sheepskins lying over a vacant lot downtown drying in the sun. . . . We like it because Albuquerque is still small enough that you always see somebody you know when you go downtown. We like it because the whole tempo of life is slower than in the big cities. . . .
>
> We like Albuquerque because, in spite of the great comfortable sense of isolation you feel here, still you do not suffer from over-isolation. For people here, too, live lives that are complete and full. . . .
>
> We like it here because we're on top of the world, in a way; and because we are not stifled and smothered and hemmed in by buildings and trees and traffic and people. We like it because the sky is so bright and you can see so much of it. And because out here you actually see the clouds and the stars and the storms, instead of just reading about them in the newspapers. They become a genuine part of your daily life, and half the entire horizon is yours in one glance just for the looking, and the distance sort of gets into your soul and makes you feel that you too are big inside." (reprint permission from *New Mexico Magazine*)



HOW DID WE GET HERE?

Albuquerque's unique physical endowments have been significant factors in its settlement as well as in its recent growth and development. Readily available river and ground water, natural east-west and north-south travel routes, superb climate, and a beautiful setting have attracted waves of immigrants for more than 600 years. Most came seeking the good life; most were as interested in aesthetic qualities and healthy surroundings as in their economic well-being.

With the establishment of Sandia Base during World War II, and the resulting influx of new residents, Albuquerque quickly developed into a full-fledged city. The "good life" of sunshine, healthy air, and scenic vistas was supplemented by the amenities and vitality associated with life in other metropolitan areas. The city became diverse and cosmopolitan, culturally and aesthetically stimulating, while continuing to enjoy many of the attributes of a small town.

At the same time that urbanization was adding a new dimension to Albuquerque's attractiveness as a place to live, many older American cities were entering a period of rapid deterioration. Poverty, slums, racial tensions, crime, alienation, flight of the middle class, and pollution fed on each other in the familiar syndrome of urban decay.

Albuquerque is not immune to these negative consequences of urbanization, but steps can still be taken to solve these problems before it is too late.

- It is still relatively clean. Litter on streets and vacant lots, the result of winds as well as thoughtless litterbugs, is a matter of community concern and action.
- Air quality, no longer as pristine and healthful as it was several years ago because of the increasing number of automobiles, could be quickly restored with appropriate measures to reduce auto traffic and to provide adequate mass transportation.
- Urban sprawl, although it has made substantial inroads upon the inviting open spaces, may still be checked.
- Crime may be a factor to contend with, but Albuquerqueans are not afraid to greet a stranger with a smile, or to extend a helping hand. People have a sense of community; they interrelate with friendliness and good spirit.

GO (SOUTH) WEST, YOUNG MAN

A Harris Poll in 1978 indicated that many people living in large cities desired to live somewhere else. Of those who said that they wanted to move, the general response was a desire to move to a quieter, smaller, slower-paced environment.

Many of these people are moving to the sunbelt states of the South and West. Disturbing parallels can be drawn between this new South/Westward migrant and the familiar one of a century or more ago. The same buffalo-hunter mentality is apparent to some degree:

"There always will be plenty, because there always has been plenty."

"Take what you want and, when it is gone, move on."

"Live for today, for tomorrow will take care of itself."

There are also differences between the new migrant and the buffalo-hunter. The new migrant is generally better educated, more affluent, and has more professional skills. The new migrant is also moving for different reasons. He is in search of a slower life-style, more open space, and generally wants to settle where the environment is more pleasant.

Various cities in the South and West are handling this population shift in different ways. Some are actively recruiting the new migrant, such as Phoenix, Arizona. Others are actively fighting the shifts. Boulder, Colorado; Petaluma, California; and Boca Raton, Florida have sought to control the influx of newcomers by imposing population ceilings, strict zoning regulations, and other restrictive measures. The advisability, effectiveness, ethic, and legality of such actions is, perhaps, debatable. Other communities, particularly small communities where there has been out-migration for the last 20 or so years, do not deal with the problem at all. Finally, cities such as Albuquerque are attempting to handle the problem by planning for controlled growth through policy direction and active involvement of their Planning Department.

Whatever the reasons, wherever the moves may be, there is a population shift and the urgency of finding some mechanism for coping with the population growth and shift cannot be disputed.

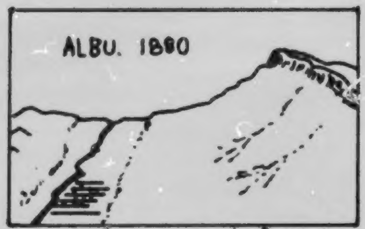
ALBUQUERQUE'S GROWTH

While Albuquerque's population explosion does not match that experienced by Los Angeles, Denver, and Phoenix, it too has grown rapidly since World War II. More growth and change have occurred in the past few decades than in the previous hundreds of years of the city's history. Its area has mushroomed and its population has increased tenfold.

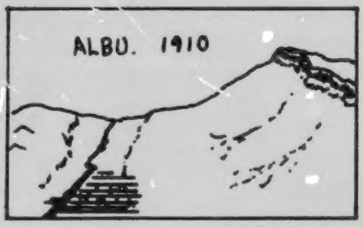
Predictions for the future range from 500,000 to twice that by the turn of the century. One estimate places Albuquerque among the 20 largest cities in the nation by the year 2000. What Albuquerque will become during the remainder of this millenium will be determined by the **limiting factors** of the physical environment and by the limits, broad or narrow, of our own foresight and planning.

PEOPLE, CITIES, AND THE ENVIRONMENT

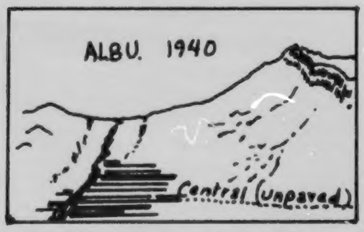
Basically, cities are people; not people in a statistical sense, but in a living sense. Everything in a city, for better or for worse, is a creation of man's intellect. Man has taken a spot of earth, has bulldozed and built, brought in and taken out, planted and killed, created and destroyed, and has fashioned a city. The end product of his efforts constitutes his **environment.**



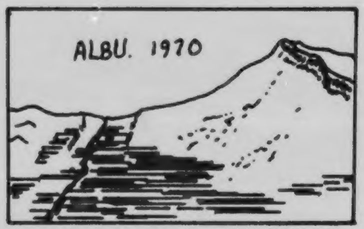
an Irrigated lowland floodplain surrounded by arid land



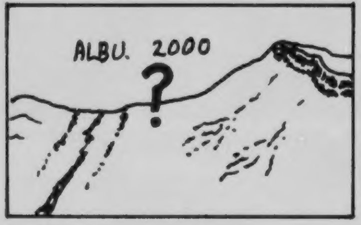
pop. 11,000 area 2000 ac. (809 ha)



pop. 35,000 area 7,000 ac. (2833 ha)



pop. 250,000 area 50,000 ac. (20,235 ha)



pop.______ area______

Environment is *everything* around us:

- that which nature has provided — air, water, climate, forests, mountains, minerals, plants, and animals
- that which humans have added (or taken away) with their intelligence, ingenuity, greed, and carelessness

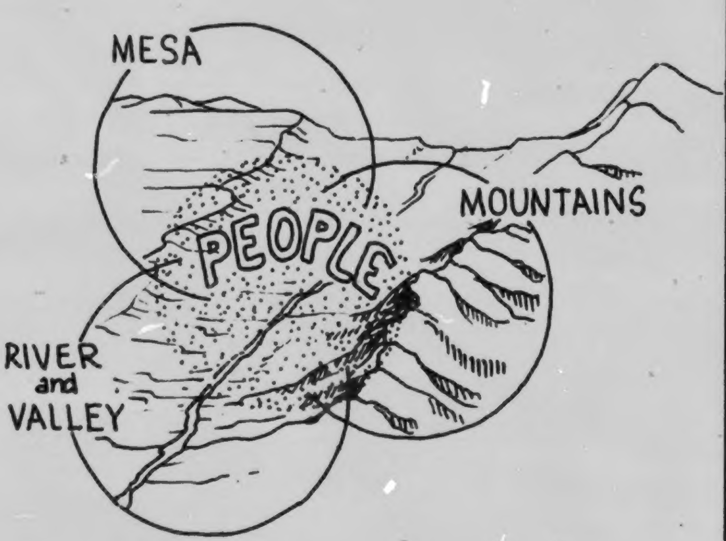
Environment is *everybody* around us:

- the people we work with, and how we do our jobs together
- our families, the people who share our neighborhood, and how we feel about each other
- the people we pass during the day, and the expressions on their faces
- the number of us who are forced to try to occupy the same space at the same time
- the litterbugs among us, and the community's commitment to keep our streets and parks clean
- the way we like to spend our time off, and the values the community places on recreation
- the feeling we have when we get up and face a new morning, and the degree of satisfaction we feel when we go to bed at the end of the day
- the extent to which we Albuquerqueans enjoy living in our city, and our concern for its future well-being

People, *like* all other animals, have needs which must be supplied by the environment: air; water; energy to sustain, move, and warm their bodies; shelter; and room, or space. People, *unlike* other animals, do not derive enough energy from their food to meet all their needs, *and wants*.

With little regard for the impact on the environment, humans use their distinctive **adaptation** — a brain which enables them to reason and think creatively — to use any mode of travel they want, and to select any part of the world as their home. They draw upon, they deplete, the natural resources around them for the energy to make their life styles desirable. If parts of people's surroundings are not to their liking, they modify the environment rather than fleeing, adapting, or dying — as other animals must do.

Man's confrontation with his environment is further complicated by social, economic, and emotional forces in human society. A growing community can befoul its air, and put its residents in competition for water and space, while simultaneously achieving a much-needed healthy economy. Each area has its maximum growth level before destructive urban decay patterns begin. Who decides which way to go?



SYSTEMS AND ECOSYSTEMS

Albuquerque is a complex web of environments, a network of ecosystems: Systems

. . . next to systems
. . . within systems
. . . overlapping systems
. . . superimposed on systems
. . . interacting with systems

Natural systems interfacing with natural systems
Natural systems interfacing with human systems
Human systems interfacing with human systems

Each of these systems came from someplace and is headed someplace. Each experiences **succession,** and is part of a dynamic continuum containing living things or **biotic** communities. These communities are subject to limiting factors imposed by the physical environment. All of the basic principles of **ecology** apply to each of these systems.

Basic knowledge of the interrelationships which exist in any system, natural or manmade, can be a valuable aid in learning how to make wise use of the natural environment with which the city is endowed. The systems and the principles involved are the same whether the community studied consists of plants and animals living on a mesa, in the mountains, along the banks of the river, or on a school lawn. They apply to the human community which makes up our city, as well as the natural areas around us.

A **system** consists of organized interrelationships of matter and energy. Change in one part of a system's organization affects change in all other parts of the system. Some systems in nature are:

- carbon dioxide — oxygen cycle
- nitrogen cycle
- phosphorous cycle
- photosynthesis
- water cycle
- soil formation
- decomposition

Some systems in human societies are:

- agriculture
- manufacturing
- transportation
- waste disposal

These human systems are, in turn, regulated by "control systems" such as political institutions, economic practices, recreational pursuits, aesthetic and religious values, and educational objectives.

The common denominators for all systems might be described as follows:

- Every system has inputs and outputs and energy transfers.
- Systems involve transfer of energy in the collection, storage, distribution, and conversion of raw materials.
- Changes in quality, direction, or rate of flow in any part of the system affect the whole system.
- Usable materials go into a system, and waste materials come out of it.
- Everything is interrelated. (Arbitrary boundaries such as the CO_2-O_2 cycle, food chains, and the nitrogen cycle are assigned for ease in observing and studying a system.)

The extent to which the public is made aware of basic principles of an **ecosystem,** that is, the community and its interrelationship with its environment, and is responsive to their implications will determine whether the Albuquerque of the future can retain the lifestyle and the quality of life considered so desirable by most of us who live here.

Fortunately, we still have options. We can prepare for health, survival, and fulfillment through planning and education. Or, failing this, we can risk the urban decay, economic disintegration, and flight of population which are destroying too many American cities. The children we teach will soon become the community's decisionmakers. We can help them develop the objective criteria, the fact gathering and judgmental skills they will need if they are to cope effectively with the almost unpredictable complexities of governing a city at the end of the 20th century.

It is the hope of many that Albuquerque in 2000 A.D. will still understand what Ernie Pyle was talking about. This book has been prepared with that goal in mind . . . that schoolchildren, teachers, and adults in the community will be moved to learn enough about the area's human and natural systems to cherish them, and to cherish them enough to preserve them.

> "A trip back East never fails to strengthen my appreciation for what we have here and my determination to keep New Mexico a good place to live. Such a trip is a reawakening to all the ugliness we can inflict upon ourselves if we don't care for what we have, and don't exercise vigilance to preserve it."
>
> Dick Knipfing KOAT-TV Commentary

Section I

ALBUQUERQUE'S NATURAL ECOSYSTEMS

INTRODUCTION

At first glance, Albuquerque's natural environment is notable for its three, diversified geographic features:

- the Sandia/Manzano Mountains forming a dramatic backdrop east of the city
- the Rio Grande and its **bosque** and valley
- the West Mesa and the volcanoes rising above it

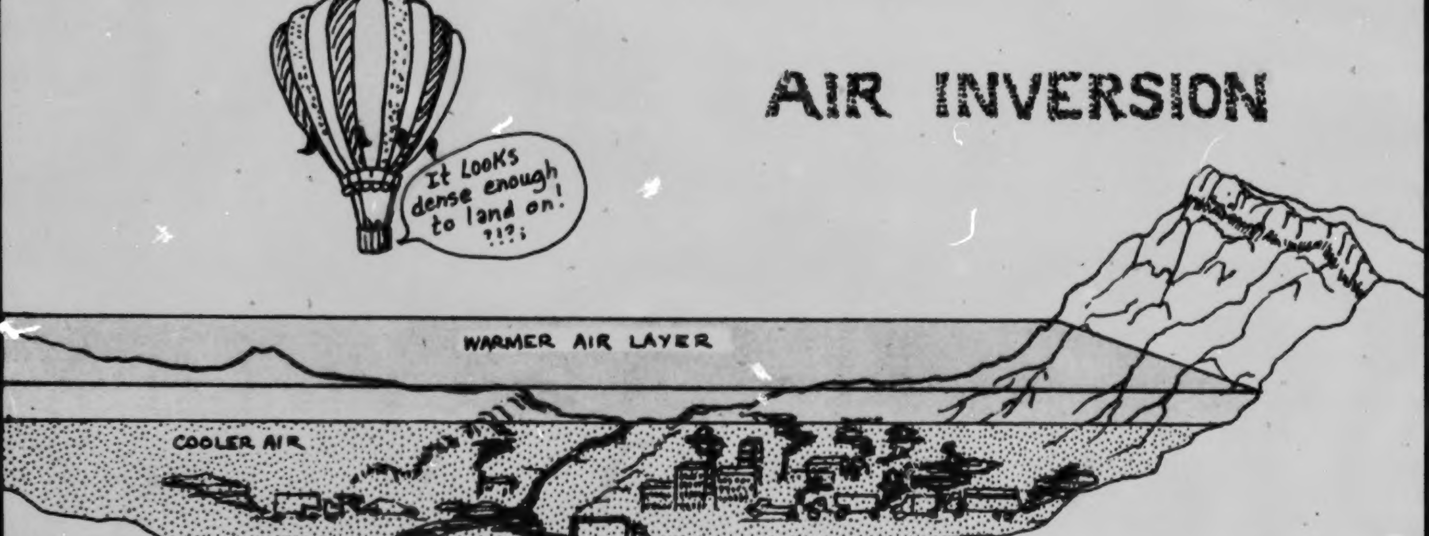
Four seasons, four life zones, and three major, distinctive geologic regions combine to give the city a unique, attractive, and vigorous quality. The sole, unvarying aspect of the Albuquerque scene is the sunny climate, and few would complain about that type of uniformity.

CLIMATE AND WEATHER

The city's pleasant year-round climate is attributable to a blend of its latitude and altitude. Albuquerque is just far enough south to be spared many of the storms which sweep across the country from the northwest, and which often touch southern Colorado and northern New Mexico. An altitude of approximately 5000 feet spares the city the extreme heat which is characteristic of Phoenix and other lower altitude cities in the same latitude. The altitude also provides four distinct, but temperate, seasons. The average daily range of temperature is relatively high, but extreme temperatures are rare. Normally there is no more than one day a year when the temperature either reaches 100°F (37°C) or drops to O°F (−18°C).

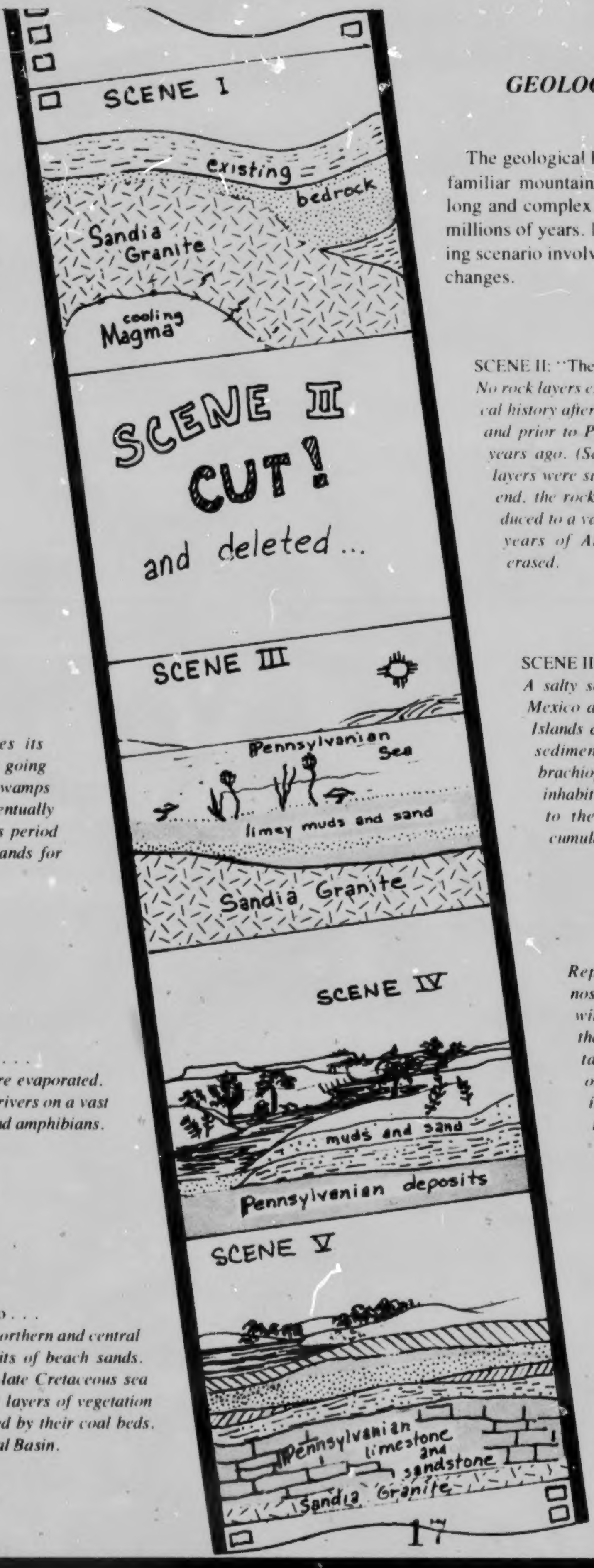
The Sandia Mountains to the east of Albuquerque represent a broken segment of the almost continuous Rocky Mountain chain extending the length of the continent from north to south. They present an obstruction to the atmospheric flow which exerts a strong influence on the local weather of the Central Rio Grande Valley. Many east-side polar cold air outbreaks are prevented from engulfing the city (although occasionally "leaking" through Tijeras Canyon as a zephyr). Humid summer air from the Great Plains and thunderstorm-spawned tornadoes are usually kept at bay by the nearly mile-high barrier. Summer showers frequently cluster along the mountains as moist air is carried aloft by rising air currents generated by sun-heated slopes, thus doubling or tripling the average annual precipitation over that received by the adjacent valley.

Albuquerque's setting of low average humidity, little cloud cover, and broad, deep valley location, is highly conducive to regular formation of significant atmospheric stable layers or **temperature inversions.** Normally, during the day air temperature decreases with altitude, but after a clear, calm night the air next to the ground becomes cool relative to the air above. Thus, the temperature-height profile is said to be "inverted" from the usual mixed situation, and what is known as an inversion or stable layer exists which effectively suppresses vertical mixing activity. Inhibited mixing means that dispersal and concentration reduction of emitted pollutants within or below the inversion are greatly reduced. Thus, the combinations of stable air and extensive pollutant emitting sources (mostly automobiles) throughout Albuquerque, combine to cause frequent episodes of unacceptably large air pollution concentrations.



GEOLOGICAL HISTORY

The geological history which led to the city's familiar mountain/valley/mesa trough shape is long and complex, extending back hundreds of millions of years. It's story unfolds as a fascinating scenario involving a series of dramatic earth changes.



SCENE I
existing
bedrock
Sandia Granite
cooling Magma
SCENE II
CUT!
and deleted ...
SCENE III
Pennsylvanian Sea
limey muds and sand
Sandia Granite
SCENE IV
muds and sand
Pennsylvanian deposits
SCENE V
Pennsylvanian limestone and sandstone
Sandia Granite

SCENE I: 1.5 billion years ago . . .
Hot, liquid rock ***(magma)*** *is injected into existing bedrock, cooling and resolidifying into granite deep below the earth's surface.*

SCENE II: "The Great Unconformity"
No rock layers exist here to tell us of the geological history after the formation of Sandia granite and prior to Pennsylvanian times 300 million years ago. (See SCENE III.*) No doubt rock layers were successively deposited but, in the end, the rock was eroded, our area was reduced to a vast, low* ***peneplain****, and a billion years of Albuquerque history was thus erased.*

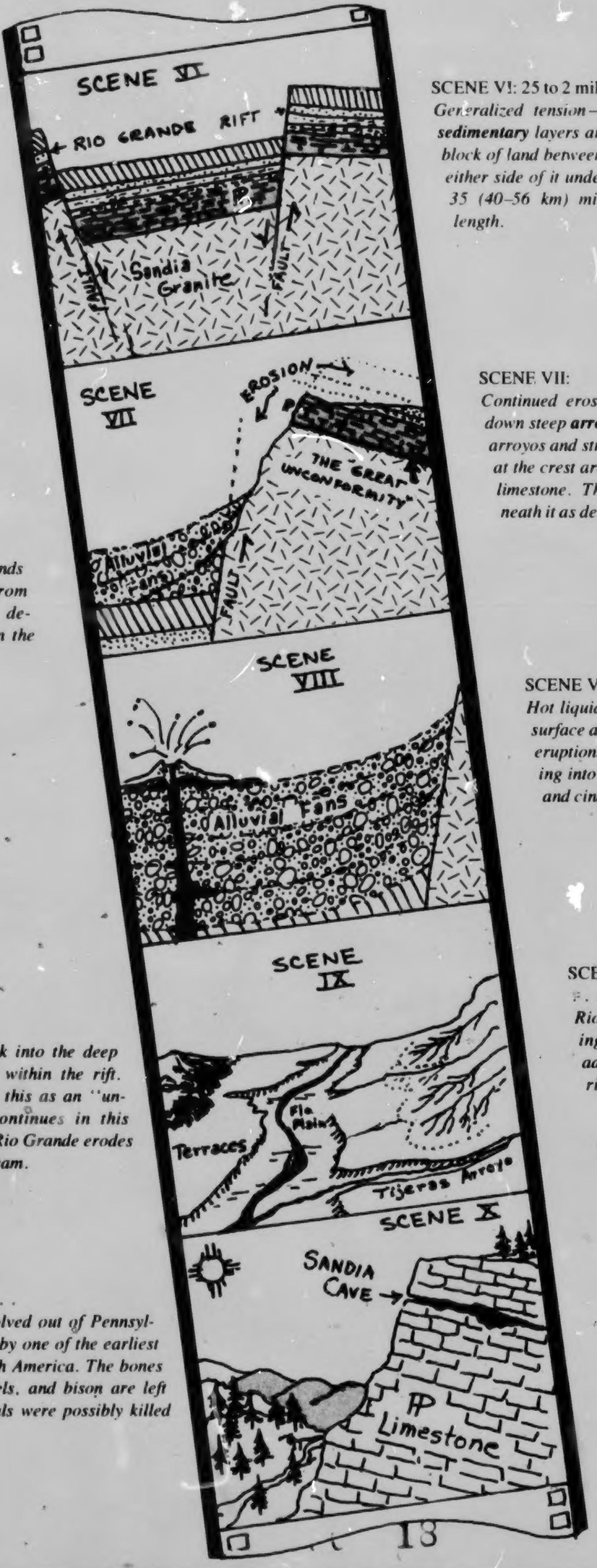
SCENE III: 300 million years ago . . .
A salty sea advances into most of New Mexico and spreads onto the peneplain. Islands and uplands erode, contributing sediments to adjacent seas. Corals, brachiopods, crinoids, and bryozoans inhabit the waters adding their bodies to the salts, sands and muds accumulating on the floor of the sea.

The Pennsylvanian period takes its name from the geological activity going on at this time in Pennsylvania: swamps filling with peat which would eventually become the coal which made this period so notable. The symbol "IP" stands for Pennsylvanian rocks.

SCENE IV: 250 million years ago . . .
Pennsylvanian seas retreat and are evaporated. Muds and sands are deposited by rivers on a vast flood plain inhabited by reptiles and amphibians.

Reptiles, dominated by the dinosaurs, still rule the earth, but wily mammals give evidence of their mental superiority and adaptability. Deciduous trees . . . oak, maple . . . become common in the local environments suited to them.

SCENE V: 90-70 million years ago . . .
Another major sea advances into northern and central New Mexico leaving thick deposits of beach sands. Inland from the shoreline of this late Cretaceous sea lay swamps which locally deposit layers of vegetation in areas which are now recognized by their coal beds. One such deposit is the Tijeras Coal Basin.


SCENE VI
RIO GRANDE RIFT
Sandia Granite
FAULT
FAULT
SCENE VII
EROSION
THE "GREAT UNCONFORMITY"
Alluvial Fans
FAULT
SCENE VIII
Alluvial Fans
SCENE IX
Terraces
Flo Plain
Tijeras Arroyo
SCENE X
SANDIA CAVE
IP Limestone

SCENE VI: 25 to 2 million years ago . . .
Generalized tension—stretching—causes faulting of the ***sedimentary*** *layers and the* ***igneous*** *granite bedrock. The block of land between the faults subsides as the blocks on either side of it undergo* ***uplifting****. A* ***rift*** *is formed 25 to 35 (40–56 km) miles wide extending many miles in length.*

SCENE VII:
Continued erosion of mountains carries materials down steep ***arroyos*** *to the rift and down more gentle arroyos and streams on the eastern side. Top layers at the crest are eroded off exposing Pennsylvanian limestone. The "Great Unconformity" lies beneath it as described in* SCENE II.

Alluvial fans *composed of sands (from sandstone), muds (from shale), limestone bits, and decomposed granite form within the rift, one on top of another.*

SCENE VIII: 190,000 years ago . . .
Hot liquid magma finds several routes to the surface along a fault line *within the rift. Fluid eruptions contribute flows of magma solidifying into lava; explosive ejections add* scoria *and cinders.*

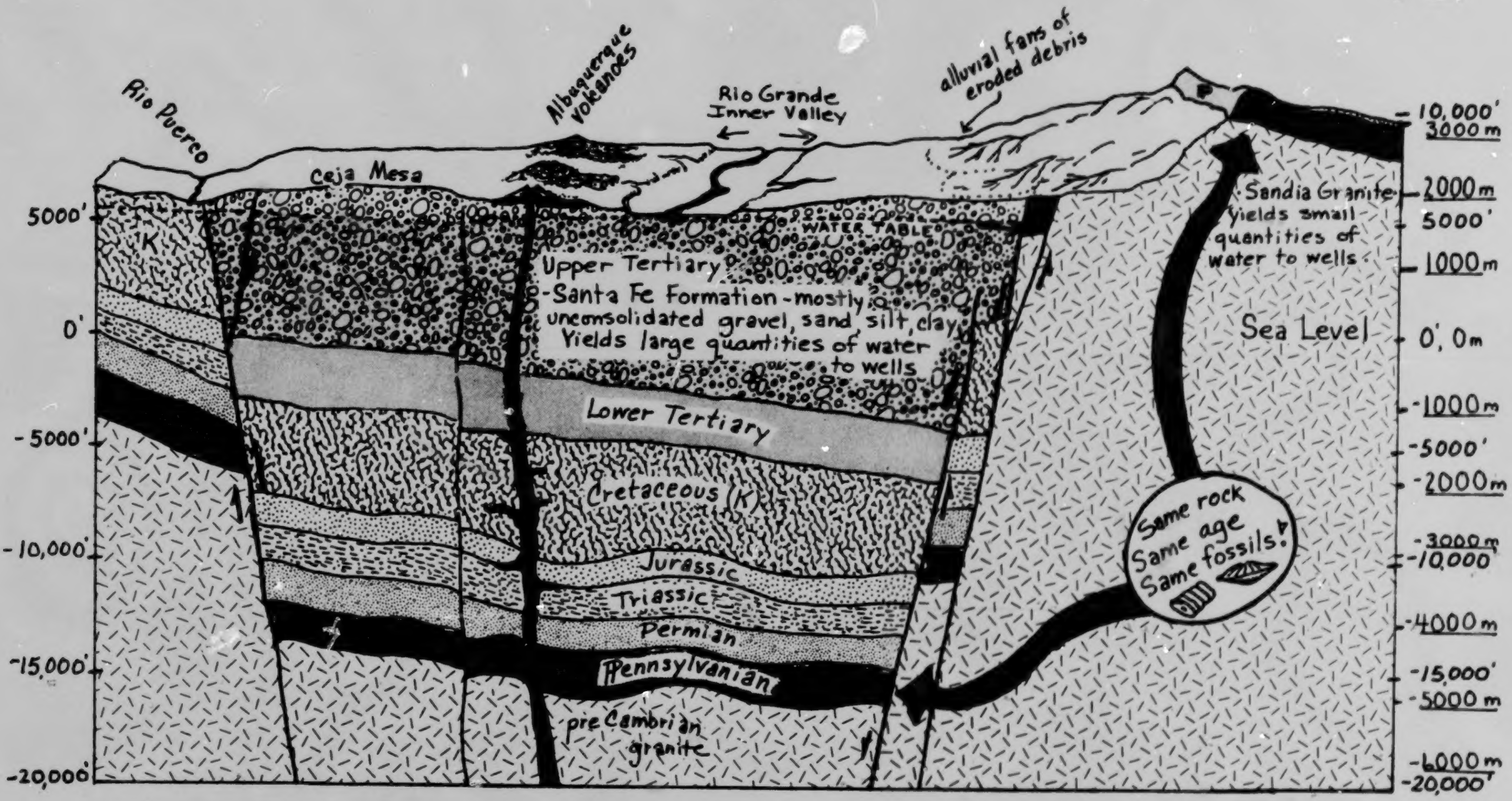
SCENE IX: within last 100,000 years . . .
Rio Grande takes route of rift depositing on its flood plain materials which add to the fertility of the alluvial materials eroded from the mountains . . .

. . . Rio Grande waters soak into the deep layers of sands and gravels within the rift. (People occasionally refer to this as an "underground lake.") Uplift continues in this region—terraces form as the Rio Grande erodes and carries materials downstream.

and then came MAN . . .

SCENE X: 15,000 years ago . . .
Sandia Cave, previously dissolved out of Pennsylvanian limestone, is occupied by one of the earliest known Indian cultures in North America. The bones of mastodon, mammoth, camels, and bison are left within the cave. (These animals were possibly killed with stone-tipped lances.)

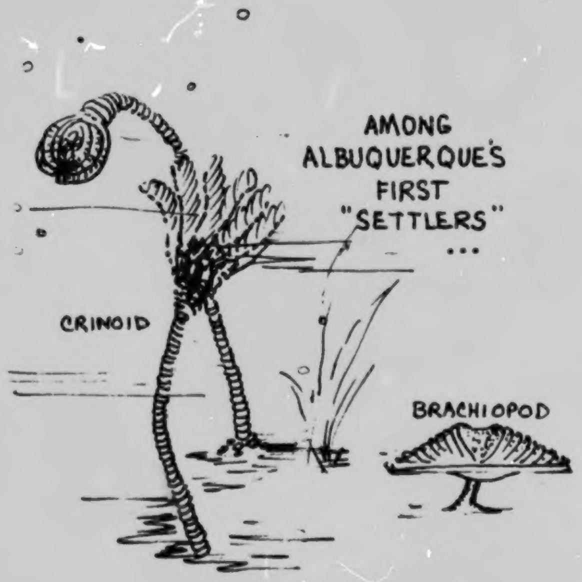
THREE-DIMENSIONAL VIEW OF THE RIO GRANDE RIFT IN THE ALBUQUERQUE REGION


Rio Puerco
Ceja Mesa
Albuquerque Volcanoes
Rio Grande Inner Valley
alluvial fans of eroded debris
K
WATER TABLE
Upper Tertiary
-Santa Fe Formation - mostly unconsolidated gravel, sand, silt, clay
Yields large quantities of water to wells
Lower Tertiary
Cretaceous (K)
Jurassic
Triassic
Permian
Pennsylvanian
pre Cambrian granite
Sandia Granite yields small quantities of water to wells.
Sea Level
Same rock
Same age
Same fossils!
5000'
0'
-5000'
-10,000'
-15,000'
-20,000'
10,000'
3000 m
2000 m
5000'
1000 m
0', 0m
-1000 m
-5000'
-2000 m
-3000 m
-10,000'
-4000 m
-15,000'
-5000 m
-6000 m
-20,000'

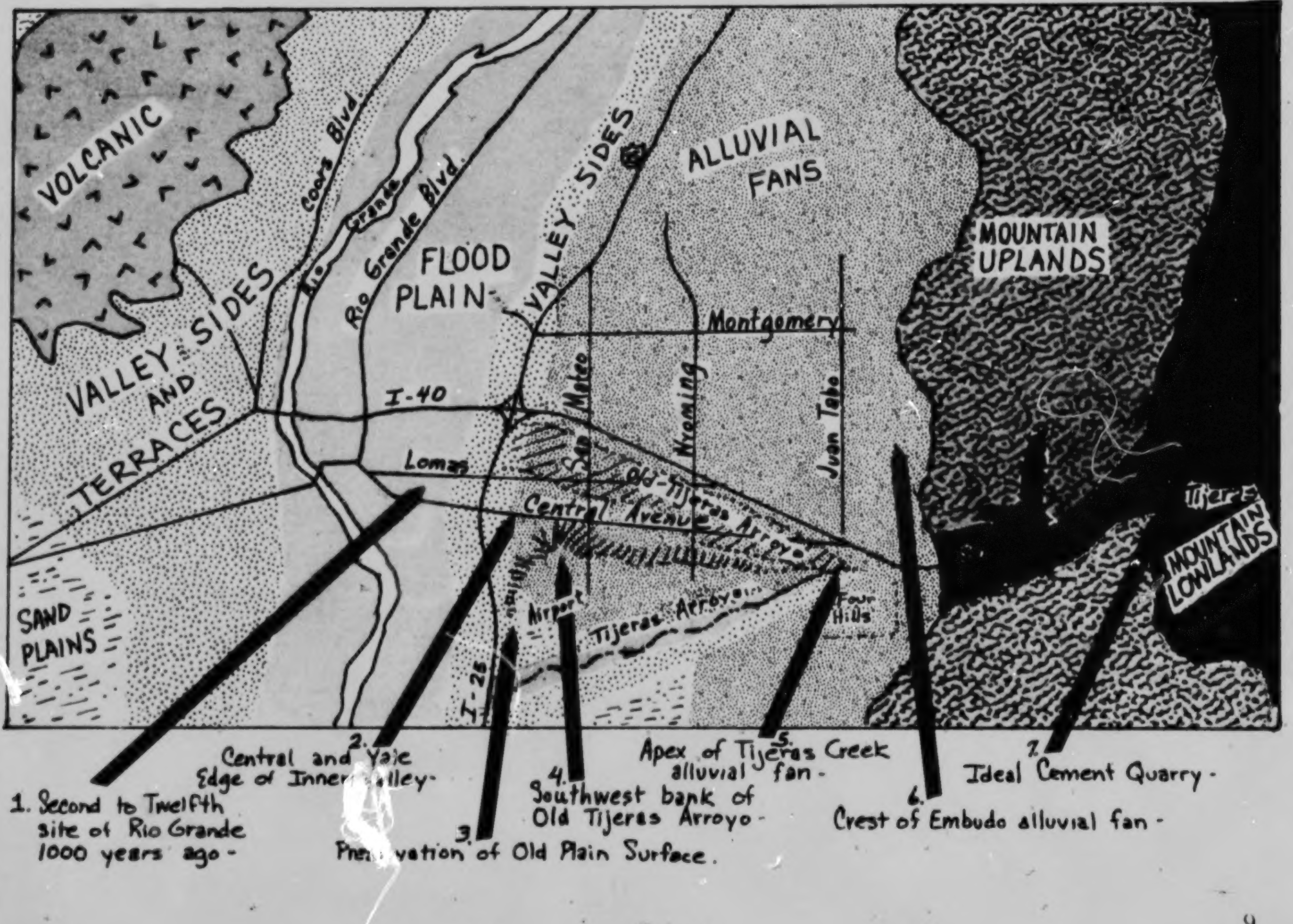
HIDDEN GEOLOGY

Most of us notice with renewed delight each day the grandeur of the Sandia Mountain backdrop to the east, the dramatic volcanoes to the west, and the breathtaking expanse of the Rio Grande Basin between the two. Few of us, however, are aware of the sub-regions and the mini-environments we move across while traveling around the city. We seldom relate the uphill-downhill terrain to the mesas, alluvial fans, inner valley, terraces, flood plain, arroyos, and mountain uplands and lowlands on which the city is constructed.

If we could turn the clock back thousands of years and strip the signs of civilization from the city's surface, all the natural features would be visible. Although we can't perform these miracles, we can use our knowledge of the city's geology to "look" below the roads and buildings to the land formations underlying them.

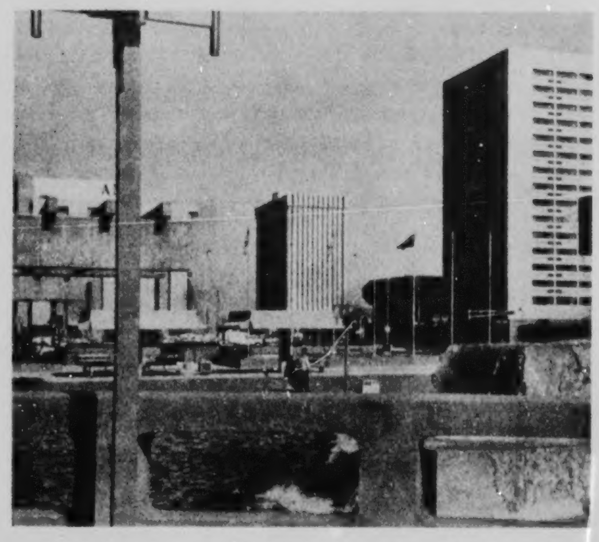

AMONG ALBUQUERQUE'S FIRST "SETTLERS" ...
CRINOID
BRACHIOPOD

ALBUQUERQUE'S NATURAL REGIONS


VOLCANIC
VALLEY SIDES AND TERRACES
Coors Blvd.
Rio Grande
Rio Grande Blvd.
FLOOD PLAIN
VALLEY SIDES
ALLUVIAL FANS
MOUNTAIN UPLANDS
Montgomery
San Mateo
Wyoming
Juan Tabo
I-40
Lomas
Central Avenue
Old Tijeras Arroyo
Tijeras
MOUNTAIN LOWLANDS
SAND PLAINS
I-25
Airport
Tijeras Arroyo
Four Hills
1. Second to Twelfth site of Rio Grande 1000 years ago -
2. Central and Yale Edge of Inner Valley -
3. Preservation of Old Plain Surface.
4. Southwest bank of Old Tijeras Arroyo -
5. Apex of Tijeras Creek alluvial fan -
6. Crest of Embudo alluvial fan -
7. Ideal Cement Quarry -

DID YOU KNOW THAT . . .

1. . . . the Rio Grande flowed between Second and Twelfth Streets about one thousand years ago . . .



2. . . . Central Avenue' and Yale Boulevard mark the edge of the East Mesa and the beginning of the descent into the inner valley . . .

3. . . . several hundred thousand years ago, the east and west mesa formed a broad plain through which the Rio Grande flowed (about 250' or 24 m higher than its present level).

The surface of this old plain is preserved along the mesa where Coors Boulevard runs and to the east around Kirtland Air Force Base and Albuquerque International Airport.

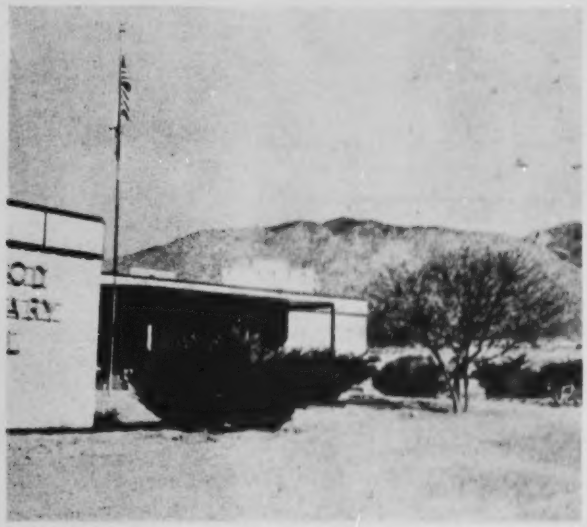
airport marina hotel
La Patrona
PRIME RIB ROOM
49c GIANT SHRIMP COCKTAIL

4. . . . Ridgecrest Drive runs southeast from Carlisle along the southwest side of Old Tijeras Arroyo . . .

(corner Ridgecrest Drive and Parkland Circle)

5. . . . thousands of years ago, when the Rio Grande cut its inner valley, Tijeras Creek flowed out of its canyon onto an alluvial fan, the apex of which lay just south of the Western Skies Motor Hotel. The path of the Old Tijeras Creek lay to the north of its alluvial fan, whereas today's Tijeras Creek runs to the south of the fan.

6. . . . the crest of the Embudo alluvial fan is near the Chelwood Elementary School on Chelwood Boulevard just beyond Constitution Avenue . . .



7. . . . hundreds of millions of years ago, the land on which the Ideal Cement Company is now located was the floor of a sea containing the marine animals we now find as ***fossils*** *. . .*

MINI-ENVIRONMENTS

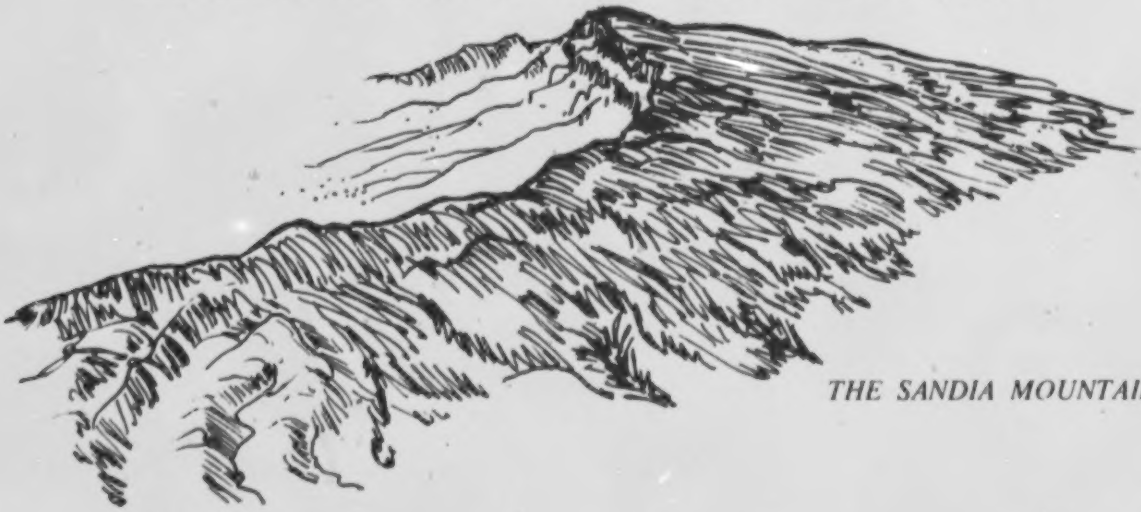
Albuquerque's geological history and its natural history have played a major role in determining the many diversified mini-environments in which we live . . . differences in **topography** influence air quality, average annual temperature, and amount and seasonal distribution of precipitation . . . slope and rock type in an area help to determine water availability and vulnerability to flooding . . . soil characteristics, in addition to all of these other physical factors, help to regulate the types and amounts of vegetation in an area . . . plant life determines the kinds and quantities of animals an environment can support.

People interact with the natural factors in their mini-environments, often without any awareness of the relationships which exist. And people are often puzzled by provocative questions about the widely differing conditions which occur within the 83 (215 km^2) square miles which make up our city.

- Why do the "scattered showers" predicted by the weatherman never seem to reach gardens in some parts of the city, and almost always fall on others?
- Why might one "backyard farmer" get better results for the same effort than another person in a different part of the city?
- Why is it harder to lay the foundation for houses in some parts of the city than in others?
- Why might someone on Rio Grande Boulevard know that many fireplaces are being used on a winter night, while someone across the river on Coors Boulevard might not?
- Why is the temperature in the Valley usually three degrees cooler in the daytime and three degrees warmer at night than in the Heights?
- Why do cottonwood trees grow naturally in the Valley and not on the Mesa just a few miles away?
- Why is it more important for some houses in the Sandia foothills to carry flood insurance than others?
- Why is it better for Albuquerque area sanitary landfill sites to be in their present locations than in the Valley?

Clues to answers for these questions can be found in the "Three-Dimensional View of the Rio Grande Rift in the Albuquerque Region" (p. 8) and in the Ecological Profiles which follow.

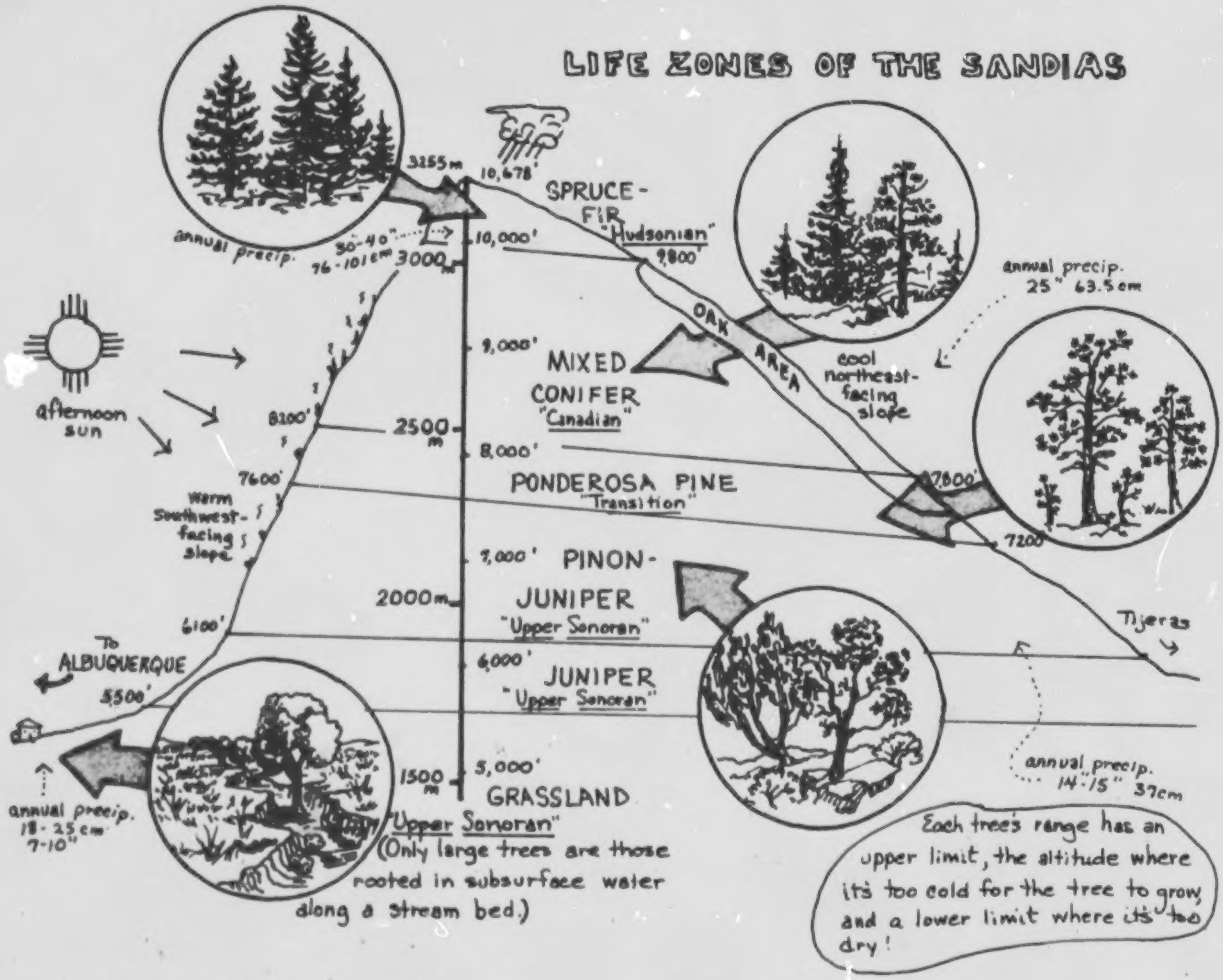
ECOLOGICAL PROFILES OF ALBUQUERQUE'S OPEN SPACES



THE SANDIA MOUNTAINS

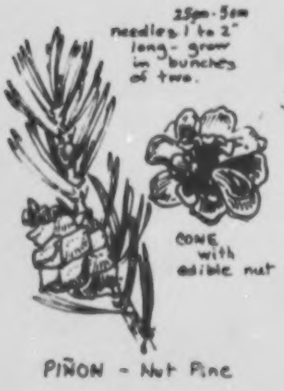
Mountain Uplands

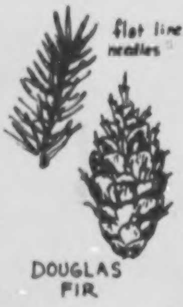
1. TERRAIN — extremely steep west-facing slopes, averaging 25% or more. Varied relief, locally exceeding 1000 feet (305 m). Marked by cliffs, pinacles, canyons.
2. CLIMATE AND AIR QUALITY — *Description:* relatively moist, cool subhumid climate. Mean annual precipitation is 18 to 25 inches (46 to 64 cm); mean annual air temperature 44°F (7°C); frost-free season 60 to 100 days; average snowfall 60 to 100 inches (152 cm to 254 cm). *Comments:* one of the highest incidences of thunderstorms in contiguous U.S. Considerable freezethaw effect; rapid snowmelts and runoff on west faces.
3. GEOLOGY — cap of several hundred feet of Pennsylvanian limestone layers alternating with shale. Remaining material is a light colored Precambrian granite with gneiss, quartzite, greenstone, and schist. *Resources or hazards:* resources are limited and access restricted. Principal hazards are landslides and erosion.
4. SOILS — *Association:* Kolab-Rock Outcrop. *Description:* dark, well-drained clay loams on steep slopes; parent material, usually limestone, sandstone, or granite. Rock outcrop accounts for 30% of association. *Notable characteristics:* permeability slow; slope severely limits nearly all man-related activity; useful for **watershed,** wildlife, nature study.

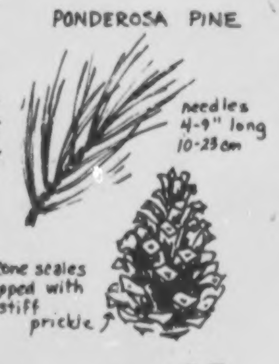

LIFE ZONES OF THE SANDIAS
3255m
10,678'
SPRUCE-FIR
"Hudsonian"
annual precip.
30-40"
76-101cm
10,000'
3000m
9,800'
OAK AREA
9,000'
MIXED CONIFER
"Canadian"
cool northeast-facing slope
annual precip. 25" 63.5cm
afternoon sun
8200'
2500m
8,000'
PONDEROSA PINE
"Transition"
7600'
7800'
Warm Southwest-facing slope
7200'
7,000'
PINON-JUNIPER
"Upper Sonoran"
2000m
Tijeras
6100'
To ALBUQUERQUE
6,000'
JUNIPER
"Upper Sonoran"
5500'
1500m
5,000'
GRASSLAND
"Upper Sonoran"
(Only large trees are those rooted in subsurface water along a stream bed.)
annual precip. 18-25cm 7-10"
annual precip. 14-15" 37cm
Each tree's range has an upper limit, the altitude where it's too cold for the tree to grow, and a lower limit where it's too dry!

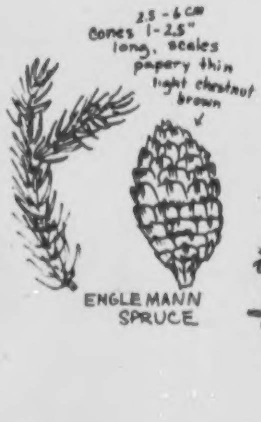
5. HYDROLOGY — parallel canyons (located along joints, faults) cut in steep mountain front, fed by short, intermittent channels. Runoff from snowmelt, thunderstorms, and from springs fed by **ground water.** Ground water otherwise available in small quantities; quality generally good. Little water use in area. Important source of water used elsewhere.

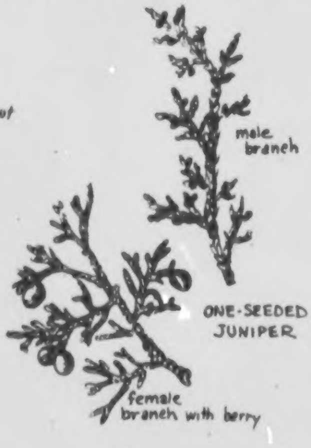
6. VEGETATION — *Zone:* Upper Sonoran foothills to Transition, Canadian, and Hudsonian on peaks. *Indicator Species:* ponderosa pine, white fir, Douglas fir, Gambel oak, pinon-juniper association below 8,000 feet (2439 m). *Productivity; sensitivity:* upper reaches serve as good grazing and cover areas for wildlife; some wood cutting, gathering of fruits and nuts and recreation occurs in lower areas. Vegetation is somewhat sensitive to overbrowsing and intrusion by man.


2.5cm-5cm
needles 1 to 2" long - grow in bunches of two.
CONE with edible nut
PIÑON - Nut Pine


flat linear needles
DOUGLAS FIR


PONDEROSA PINE
needles 4-9" long 10-23cm
Cone scales tipped with stiff prickle


2.5-6cm
Cones 1-2.5" long, scales papery thin light chestnut brown
ENGLEMANN SPRUCE


male branch
ONE-SEEDED JUNIPER
female branch with berry

Remains of the Mammoth have been found within Sandia cave and in gravel pits within city limits.

7. WILDLIFE — *Indicator Species:* bighorn sheep, mountain lion, mule deer, turkey, bobcat, Steller's jay, broadtailed hummingbird, ground squirrel, porcupine. *Value:* breeding area for bighorn sheep, mountain lion and other large animals; cover, feeding and nesting area for mountain birds.

Mountain Lowlands

1. TERRAIN — nearly level, but often rugged canyon floors with steep sides (to 80% slope). Tijeras Canyon grades SW at 1-2% and locally broadens to an intermontane basin.
2. CLIMATE AND AIR QUALITY — *Description:* climate is transitional from subhumid to semi-arid. 12-18 inches (30-46 cm) of precipitation per year; mean annual air temperature 43-55°F (6°C-13°C), frost-free season 130 to 160 days. *Comments:* valley areas subject to cold air drainage, heavy snow drifts.
3. GEOLOGY — west face is nearly all granite; south slopes show various **metamorphics;** eastern lowlands covered with limestone, shale. Numerous limestone outcrops. *Resources and hazards:* limestone (for a cement plant), shale (for a brick company), gold, fluorspar, and galena mined in past. Hazards include landslides and flash flooding.
4. SOILS — *Association:* Seis-Orthida. *Description:* well drained stony loams over clayey subsoil, forming from bedrock on nearly level to steep slopes. *Notable characteristics:* severe restrictions to engineering activities due to slope and bedrock on steeper slopes; moderate limitations where grade is less than 15% (these usually are existing slopes).
5. HYDROLOGY — structurally controlled trellis drainage pattern; larger flatbottomed canyons fed by steep, parallel canyons, in turn fed by small coalescing gullies. Streams carry snowmelt, sprint-flow, storm runoff; larger water courses such as Tijeras Creek are virtually perennial. Most flow infiltrates to stream **alluvium** or limestone aquifers. Some local water use from shallow wells; water is available in sufficient quantities for domestic purposes in most areas, but is hard and has high iron content in Tijeras area.

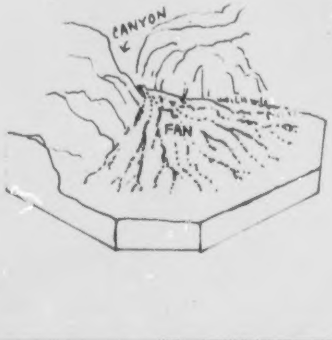
FAIRY SHRIMP
IN THE MOUNTAINS?

In 1972, after an especially heavy downpour, one mountain rancher found the puddle in his wheatfield teeming with wriggling fresh-water shrimp. Eggs lying dormant for decades had been triggered to hatch, and within a few short weeks their life cycle was completed. This phenomenon is believed to date from ancient times when the area was covered by a lake. As the climate became drier the shrimp slowly adjusted their way of life to the dwindling water supply.

6. VEGETATION — *Zone:* Transition (plateau lands). *Indicator Species:* some ponderosa pine but mainly pinon pine, juniper, mountain mahogany, sumac, and mid and short grasses; also cholla and prickly pear cactus. *Productivity; sensitivity:* less moist than upland areas and therefore productivity is limited. Some browsing, grazing, and fruit and nut picking occurs; area is easily disturbed and recovers slowly.
7. WILDLIFE — *Indicator Species:* mule deer, rock squirrel, pinon mouse, pinon jay, skunks, rattlesnakes, fence lizards. *Value:* important wintering area for mule deer and mountain birds; provides food and cover for some prairie animals.

Alluvial Fans

1. TERRAIN — smooth but fairly steep slopes (to 10% and above) near mountain front, grading westward to a gently undulating surface with slopes of 3-5%, and relief of tens of feet near arroyos.
2. CLIMATE AND AIR QUALITY — *Descriptions:* see description of "Volcanic" unit. *Comments:* like "Volcanic" unit, except that urbanized areas have major hydrocarbon, carbon monoxide, and photochemical oxidant air quality problems.
3. GEOLOGY — a series of coalescing alluvial fans (Bajada) composed of sands and gravels and younger formations, deposited in a down-dropped block (the



NORTHEAST HEIGHTS

Rio Grande rift). *Resources and hazards:* resources are limited to sand and gravel; hazards are flash flooding, mud flows, potential earth movements along fault scarps, and, in places, poor compaction.

4. SOILS — *Association:* Tijeras-Embudo. *Description:* deep, well drained gravelly sandy loams of alluvial fans, some clay in subsoil. *Notable characteristics:* rapid **percolation** rate and moderate shrink-swell; otherwise few engineering problems, generally suitable for urban development.
5. HYDROLOGY — mountain channels feed into many arroyos which spread out over the fan surface. Mountain runoff which reaches alluvial fans generally percolates into the porous material; this is a major source of recharge to the regional ground water supply. Summer storms here or in mountains may cause flash floods, now partly controlled by **diversion ditches.** Ground water found 300-1000 feet (91-305 m) beneath the surface, generally in considerable amounts in sediments of Santa Fe Formation; many municipal wells are found here which obtain water of acceptable to good quality.
6. VEGETATION — *Zone:* Upper Sonoran. *Indicator Species:* mostly mid and short grasses; some little soapweed (yucca); almost no native species in urbanized areas. *Productivity, sensitivity:* moderate grazing capacity; most disturbance, other than directly man-related, results from overgrazing or drought. Otherwise, fans are not overly sensitive to disturbance.
7. WILDLIFE — *Indicator Species:* many burrowing animals such as ground squirrel, prairie dog, field mice. Also hawks, quail, roadrunner, and numerous lizards. *Value:* undisturbed areas provide food and cover for grassland rodents and reptiles. Disturbed areas are of little value. Periodic storm run off provides additional moisture; resultant shrubby vegetation provides added cover for wildlife.

Volcanic

1. TERRAIN — aligned small volcanic cones surrounded by nearly level or eastward sloping lava flows which commonly end abruptly in cliffs up to 100 feet high. Surface slope is toward Rio Grande at 1%-15%.
2. *CLIMATE AND AIR QUALITY – Description:* moderate semi-arid climate, warm and dry. Mean annual precipitation from 7 to 10 inches (18 to 25 cm) mean annual air temperature 58-60°F (13° to 16°C); 17—195 day frost-free season. *Comments:* snowfall less than 10 inches (25 cm) per year; few relative extremes of any type; high incidence of solar insolation.
3. GEOLOGY — Consists of lava and cinders extruded from five distinct cones and eight very small ones. Activity was relatively recent (Pleistocene) in time and centered upon the west side of the Rio Grande rift. *Resources and hazards:* principle resource is scoria for cinder blocks; possible earthquake hazards.
4. SOILS — *Associations:* Alemeda-Akela. *Description:* generally shallow, well drained sandy loam, with cinders on moderately sloping, irregular basalt flows; 17% exposed basalt. *Notable characteristics:* moderate to severe limitations to overcome for most engineering activities: septic tanks, foundations, underground utilities. Basalt cobbles, shallow bedrock and excess slope are problems.
5. HYDROLOGY — irregular arroyos and small depressions, normally dry, usually incised into lavas and grade parallel toward Rio Grande. All major flows are in direct response to summer thunderstorms. Some runoff percolates into channel bottoms; the rest flows to the river, locally causing flood problems. Ground water is found at considerable depth; little information as to quantity or quality available. Some evidence of high mineralization.

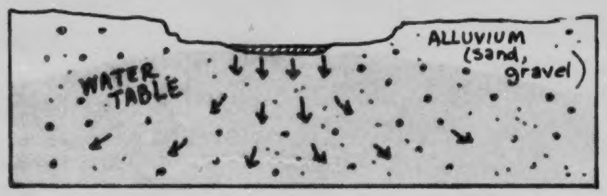
6. VEGETATION — *Zone:* Upper Sonoran. *Indicator Species:* mid and short grasses, shrubs, and annuals, such as black grama grass, snakeweed, winter fat, much cacti. *Productivity; sensitivity:* only marginal productivity for grazing or browsing animals. Sensitive to overgrazing, prolonged drought, or intrusion by man as a collector of cacti, shrubs.
7. WILDLIFE — *Indicator Species:* antelope, squirrel, coyote, skunk, many lizards, snakes, and predatory birds. *Value:* Excellent habitat for semi-desert species; good cover for burrowing animals; great variety. Provides home for relatively rare rock pocket mouse, which is endemic to lava flows.

Sand Plains

1. TERRAIN — high, flat to slightly concave surfaces often enclosed by low, broad ridges. Local slopes may exceed 3%; regional gradient is to S at 1% or less.
2. CLIMATE AND AIR QUALITY — *Description:* see "Volcanic" unit for description. *Comments:* see "Volcanic" unit for comments.
3. GEOLOGY — see description of "Alluvial Fans" unit. Upper fill is less well consolidated and reworked by wind in active and fossil dunes. *Resources and hazards:* some potential for deep geothermal wells; no other significant resources or hazards known.
4. SOILS — *Association:* Madurez-Wink. *Description:* well-drained fine sandy loam over sandy clay loams, formed from unconsolidated alluvial material. *Notable characteristics:* moderate shrink-swell, sloughing, and permeability; may be highly corrosive; fair suitability for most activities if used with care.
5. HYDROLOGY — relatively small number of broad valleys and ponding areas, almost always dry. Some local runoff following summer storms; most percolates into ground or is lost by evaporation. Ground water is found at considerable depth (and mainly results from inflow from mountain areas to the north). Use limited at present; local quality problems. Quantities generally are less than that available east of the river.
6. VEGETATION — *Zone:* Upper Sonoran. *Indicator Species:* mostly short grasses including black grama, sand dropseed, Indian rice grass; some sand sage brush, snakeweed, and winter fat. *Productivity; sensitivity:* moderate grazing capacity; good habitat for semi-desert and grassland species. Very sensitive to overgrazing.
7. WILDLIFE — *Indicator Species:* jackrabbit, kangaroo rat, coyote, and western diamondback rattlesnake, scorpion, and others as noted under "Alluvial Fans." *Value:* slightly less moist environment, but contains broader range of species because it is generally less disturbed.

Valley Sides and Terraces

1. TERRAIN — moderately to steeply sloping area grading from mesa to floodplain or river. Upper boundary marked by sharp break in slope, local relief of 50 feet (15 m) plus, and slopes often 10%. Lower areas gentler, smoother except below terraces.
2. CLIMATE AND AIR QUALITY — *Description:* warm, dry, semi-arid climate like that of mesa units, except that extremes are somewhat greater. *Comments:* susceptible to **erosion** from flash flooding and wind. Air quality problems in urbanized areas.
3. GEOLOGY — River-cut cliffs and valley sides in older river-laid terraces. Cut and fill material is composed of reworked sands and gravels of the Santa Fe group. *Resources and hazards:* principal resources consist of extensive deposits of sand and gravel; common hazards such as flooding in numerous arroyos.
4. SOILS — *Association:* Bluepoint-Kokan, Madurez-Wink. *Description:* Madurez-Wink soils on isolated river-cut terraces; see "Sand Plains" for description and characteristics. Bluepoint-Kokan soils are excessively drained loamy and/or gravelly sandy soils found as slopewash over terraces. *Notable characteristics:* locally severe water erosion, sedimentation, sloughing, corrosivity and slope problems. Otherwise use potential is moderate overall on slopes less than 15%.
5. HYDROLOGY — upper areas have closely spaced subparallel gullies which join to form arroyos; in lower areas the arroyos diffuse to broad, poorly defined drainageways or sheet flow areas, and can cause widespread shallow flooding. Flows occur in response to summer storms here or on mesa. Ground water depth varies; aquifer is Santa Fe Group. Quality is generally good; some municipal wells are in this unit.
6. VEGETATION — *Zone:* Upper Sonoran. *Indicator Species:* see "Sand Plains" unit for terrace areas; snakeweed, Russian thistle and other species indicating disturbance inhabit valley sides, along with grasses. *Productivity; sensitivity:* only marginally productive except along water courses, which are good wildlife habitats. Relatively insensitive to human activities because already severely disturbed.
7. WILDLIFE — *Indicator Species:* burrowing rodents, owls, or other animals which "adopt" burrows in valley sides, including rattlesnakes and many feral dogs from urban areas. *Value:* arroyo sides provide moist inner-city **habitats** for burrowing owls, ground squirrel, field mice. Generally, less rich fauna than in other units.



River

The Rio Grande is suitably named the "Great River." It is 1,878 miles long, extending from the foot of Stony Pass in the San Juan Mountains of Colorado to the Gulf of Mexico. In North America, it is second only in length to the Mississippi/Missouri combination.

In the Albuquerque region, the Rio Grande is a slow-moving turbid stream. Much of the channel is less than one foot deep, and the water temperature is high during the warm season. The bottom is fine sand and silt. The river channel is of marginal value to most aquatic species due to high turbidity, lack of light penetration for aquatic plants, and the high temperatures.

Shore and wading birds and some waterfowl utilize mud flats and open water. Emergent plants such as bullrushes, sedges, and cattails grow on the margins of the channel.

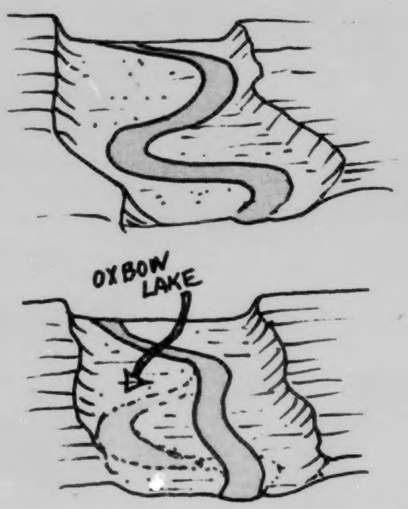
"The Rio Grande is a linear oasis traversing a semi-desert metropolis . . . an exotic river . . . the river itself meanders between levees approximately 2000 feet (610 m) apart. A large length of the river's edge in the west-central portion of the metropolitan area is a low bluff rather than a levee. On the landward side of the levee is a deep drain flowing full with returned water. The riverside drain and levee are like a moat protecting a castle from invaders." —*City Edges Study*

A network of drains and irrigation canals are distributed throughout the valley. These are maintained periodically by the Middle Rio Grande Conservancy District.

Irrigation ditches are dry from October to March, but the drain system has water all year.

Drains and canals are usually lower in turbidity than the river, and a variety of aquatic plants such as algae, bullrushes, sedges, duckweed, milfoil, and stonewort may become established. When ditches are not maintained, they develop **marsh**-like conditions with good diversity and productivity.

The marsh vegetation—cattail, bullrush, sedges, watercress and algae—and the surrounding cottonwoods, provide food, cover and breeding habitat for waterfowl, amphibians, beaver, muskrat, and a variety of songbirds.



Oxbow lakes are remnants of a stream's previous meanderings. A 37-acre cattail marsh, the "Oxbow," formed at the outfall of the Corrales Dam, is an old oxbow on the west side of the river.

Valley Floodplains

1. TERRAINS — broad flat valley bottom, grading southward parallel to Rio Grande at about 0.1%. Natural slopes do not exceed 1%; minor local relief between old terraces, swamps. Man-made relief features (streets, canals) are dominant.
2. CLIMATE AND AIR QUALITY — *Description:* semi-arid bordering on arid climatic conditions. Mean annual precipitation 7-8 inches (18-20 cm); mean annual air temperature 53-54°F (12°C); frost free season 165-185 days. *Comments:* extreme temperature ranges; greater evapotranspiration rate; high incidence of cold air drainage and local inversions. An air quality problem area.
3. GEOLOGY — the top 75 feet (23 m) of the floodplain consists of recent alluvial fill from the Rio Grande; below that is much older fill of the Santa Fe Formation. *Resources and hazards:* principal resources are ground water, **adobe** soil, and farmland. Main hazard is flooding.
4. SOILS — *Association:* Gila-Vinton-Brazito. *Description:* level to gently sloping, well-drained loams of the Rio Grande **floodplain.** *Notable characteristics:* principle hazards are shallow water table, flooding, and ditchback sloughing. Good to excellent development potential for all categories. 20% is saline or alkaline.
5. HYDROLOGY — The Rio Grande is a braided, slightly meandering river which flows at an elevation above the floodplain. Drainage in the latter is largely internal, or by man-made ditches. The river is fed mainly by meltwater from the northern New Mexico mountains. The floodplain proper receives flow from local arroyos; flooding now being brought under control by diversions and holding ponds in the "Valley Sides" unit. Groundwater is very shallow, fed by river seepage and percolation of irrigation water; the latter is diverted in large amounts from the Rio Grande. Alluvium forms an upper aquifer up to 120 feet (37 m) thick; water is hard and frequently polluted. City wells in the Santa Fe Formation below obtain abundant water of good quality. Numerous domestic, commercial and irrigation wells also occur and local drawdown effects are pronounced.
6. VEGETATION — *Zone:* Upper Sonoran grading slightly into Lower Sonoran; Bosque along water courses. *Indicator Species:* alkali sacaton, inland salt grass, fourwing saltbush; trees include cottonwood, Russian olive, and salt cedar. *Productivity; sensitivity:* good natural and agricultural productivity; average alfalfa yield, the main crop, is 4.7 tons (11.6 MT per hectare) per acre. Highest natural productivity occurs where groundwater is more plentiful.
7. WILDLIFE — *Indicator Species:* ducks, shorebirds, muskrat, beaver, skunk, roadrunner, Norway rat. Also some fish and many reptiles and amphibians are common. *Value:* used as flyway for migratory birds; provides breeding sites, feed, and cover for grassland and aquatic species; locally rare wetland habitats for **riparian** woodland creatures.

FITTING THE PIECES TOGETHER

The isolated factors described for each of Albuquerque's major systems—mountain, mesa, river, valley—fit together like the pieces of a jigsaw puzzle, forming ecologically integrated pictures. The information in the sequence below is an example of how each of the ecosystems analyzed on the previous pages can be viewed holistically, as they occur in nature.

*Plant Succession and Maintenance in the Bosque**

1. Ecological conditions in the bosque represent an abrupt change from those in surrounding mesa areas due to availability of groundwater.
2. Trees in the bosque moderate climatic extremes by raising the relative humidity through evapotranspiration, lowering temperature through shading, and providing a buffer for wind and blowing dust.
3. Marked temperature inversions are produced when cold air from surrounding uplands flows into the valley at night. High relative humidity of the bosque adds a chill factor.
4. Four main tree types dominate in the bosque. These are Rio Grande cottonwood, Russian olive, tamarisk (salt cedar), and at least four species of willow.
5. Exotic (introduced) trees such as Russian olive and tamarisk first became established in disturbed areas. Tamarisk grows particularly well along riverside drains where the root structure of native trees has been disturbed by dredging. More data is necessary to describe the succession pattern for exotics. Tamarisk appears to have the potential for replacing willow in some areas.
6. Where cottonwood grows it appears to be the climax species due to its greater height and canopy. Recent stands are mixed with Russian olive.
7. Thick cottonwood bosques are relatively unproductive for most wildlife, although they provide important cover. Disturbed areas, such as old burns which are returning to forest, provide more useful food production.
8. The succession pattern on burned areas varies with the severity of the fire, soil, water conditions, and other factors. These stages can be recognized in most burned areas:

Grass stage: Low grasses such as dropseed, wolftail.

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*Reprinted from Albuquerque's *City Edges Study*

Herb Stage: Yellow and white sweet clover, curly dock, sunflower.

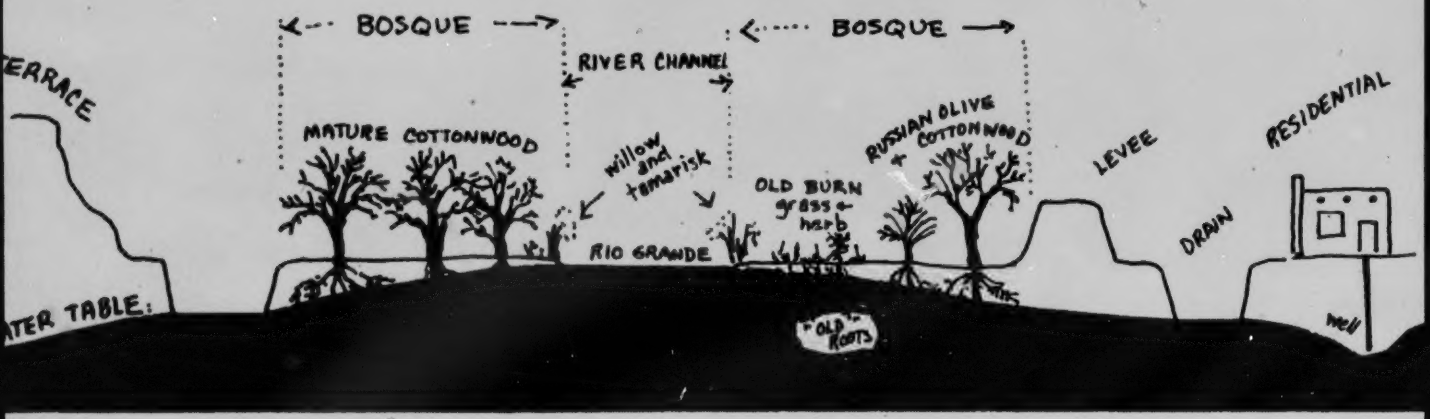
Scrub Tree Stage: Coyote willow often dominates due to its rapid growth; also cottonwoods sprouting from old roots, Russian olive, and some tamarisk. Exotic trees are most likely to make inroads during this stage.

Mixed Bosque Stage: (most common) Cottonwoods beginning to dominate with varying mixture of Russian olive, willow, and tamarisk; some scattered exotic ornamentals such as Chinese elm.

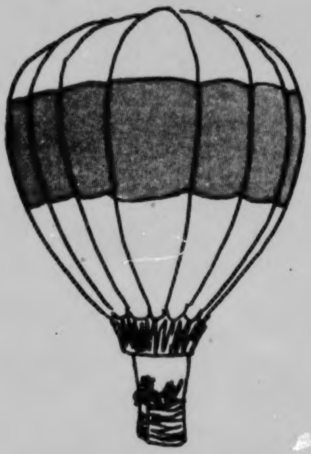
Mature Cottonwood Bosque: (climax community) Dense canopy shades out most other trees. These homogeneous stands are rare in the floodway due to woodcutting and channelization efforts.

9. Flooding seems to play an important role in reseeding bare areas with trees. An even-aged mixed bosque east of the La Luz subdivision was seeded during a flood in the spring of 1941.
10. Root systems of cottonwoods and other large phreatic trees are vast. Fires burn only what is above ground leaving roots to sprout new trees. The estimated length of time for regeneration of a burned-over cottonwood forest with canopy is 20-30 years, depending on the severity of the fire.
11. While burned areas are regenerating, they provide important wildlife feeding areas. Large flocks of doves congregate in these old burns to find seeds and gravel.
12. All types of trees and some herbs are used by nesting birds. Dense thickets of coyote willow along watercourses appear to be most heavily used. Some birds such as the blue grosbeak nest in curly dock 2½ ft. above ground, while the redwing blackbird prefers reeds and cattails for its nests.
13. Wintering mountain birds such as the Steller's and scrub jays, junco, robin, and white-crowned sparrow rely heavily on the bosque for winter food and cover.
14. Seeds of the Russian olive have been referred to as "river dates" by Albuquerque residents. They are utilized by red-shafted flickers, robins, crows, starlings, and even ducks when they grow close to the water or ground. The seeds remain on the tree through the winter and are an important wildlife food crop.
15. Mature trees help to keep the river in its channel. In addition, they can lower water temperature by providing shade.
16. The cottonwood is selfpruning. Much of the deadfall and broken limbs remain on the ground making passage through thick bosque difficult and adding to the fire hazard.
17. Bosque vegetation is extremely hardy and resilient when compared to most southwestern vegetation. Most bosque plants tap the water table and therefore have an almost constant supply of water.

PRESENT BIO-PROFILE OF THE MIDDLE RIO GRANDE VALLEY



The information in Section 1 is based on the Environmental Protection Agency report: *Final Impact Statement for Albuquerque Wastewater Treatment Facilities*, Project No. C-35-1020-01 (Dallas, Texas: Environmental Protection Agency, 1977).



"Our wants and needs are totally dependent
on the natural ecosystems of the
Albuquerque area, and our use of the above
area is dependent on our knowledge
of how these systems work."

Staff—Outdoor
Education Center

"Asi Es Nuevo Mejico"

Un canto que traigo muy dentro del alma
Lo canto a mi estado—mi tierra natal.
De flores dorada mi tierra encantada
De lindas mujeres—que no tiene igual.

Asi es Nuevo Mejico
Asi es esta tierra del sol
De sierras y valles de tierras frutales
Asi es Nuevo Mejico

El Negro, el Hispano, el Anglo, el Indio
Todos son tus hijos, todos por igual.
Tus pueblos y aldeas—mi tierra encantada
De lindas mujeres que no tiene igual.

El rio del norte, que es el Rio Grande.
Sus aguas corrientes fluyen hasta el mar
Y riegan tus campos
Mi tierra encantada de lindas mujeres
Que no tiene igual.

Tus campos se visten de flores de mayo
De lindos colores
Que Dios les dotó
Tus pajaros cantan mi tierra encantada
Sus trinos de amores
Al ser celestial.

Mi tierra encantada e historia bañada
Tan linda, tan bella—sin comparacion.
Te rindo homenaje, te rindo cariño
Soldado valiente—te rinde su amor.

Amadeo Lucero Velarde

SUGGESTED INFUSABLE AREAS OF THE CURRICULUM

Grade	Subject Area	Topic	Activities
K	Social Studies	*Family Life in New Mexico:* Community activities of the family and how they are influenced by climate, location, and natural resources	3
1	Social Studies	*Family Life in New Mexico:* Community activities of the family and how they are influenced by climate, location, and natural resources	
	Science	*Organisms:* observing organisms and where they live	1
2	Social Studies	*City of Albuquerque:* geography of Albuquerque—globe and map orientation; location of recreation areas; climatic effects; natural resources of area; scenic beauty	1, 2, 7, 11
	Science	*Life cycles:* plant life cycles; animal life cycles; biotic potential	7
3	Social Studies	*Southwest Region:* general knowledge of landforms and location; effect of land on making a living and effect of making a living upon the land; climate	1, 9, 11, 13
	Science	*Populations*	7
4	Science	*Environments:* an organism's environment; the changes outside; animal responses to environmental factors; plant responses to environmental factors	1, 4, 17
5	Social Studies	*Geography of New Mexico and the Southwest:* location of specific landforms; use of specific landforms	10–13
	Science	*Communities* *Outdoor Education Center* Program	1–3, 5–7
6	Social Studies	*Growth of Technology:* current landuse; recreational land use; agricultural use; mineral use; State and National Forests	8, 9, 12–14
		Roots: "What are the physical characteristics of New Mexico?"; major landforms; water forms; climate; flora; fauna	1, 2, 7, 10, 11, 13, 15, 16
	Science	*Ecosystems:* "inventing" ecosystems; water cycles; cycles in an ecosystem	1–7
		Middle School Science Curriculum:	1–7, 10, 11, 13–16

I. 1. m. Using Your Sense of Smell
2. a. Plant or Animal
2. c. It's A Small World
3. g. Updrafts
3. o. Pinwheel, Windmill and the Wind

III. 1. e. Oh, Give Me a Home
1. f. What's In the Zoo
1. j. Temperature as an Environmental Factor
1. k. Light as an Environmental Factor
1. m. Raindrops Keep Falling
1. n. Dead Is Dead
5. a. Population Boom
5. b. What Is Biodegradable?
6. a. Making a Time Ruler
6. b. How to Read Rocks
6. c. The Study of Fossils
6. d. Making Fossils
7. a. Air Quality
7. b. Sick Air
7. e. Garbage

		7. h. Thermal Inversion	
		7. i. Warming the Babies' Milk	
		9. a. Food Chains	
		9. d. Decomposers in the Food Chain	
		IV. 1. a. Power-Packed Beans	
		1. d. An Icy Problem	
		1. f. Erosion Problems	
		1. h. Mountains: A Building Process	
		2. a. Soft Rocks and Hard Rocks	
		2. b. Making Artificial Rocks	
		2. c. Soil Compositions	
		2. d. Soil Layers	
		2. e. Effect of Water on Rocks	
		2. f. Erosion of Rocks from Water Action	
		2. g. Ability to Hold Water	
		2. h. Soil Properties	
		3. a. Moisture in the Atmosphere	
		3. b. Rain: A Form of Precipitation	
		3. c. Formation of Clouds	
		V. 3. a. Full of Hot Air	
7	Social Studies	*Physical Geography:* latitude *Earth-Sun Relationships:* seasons and zones *Climate:* factors that affect climate; mountain barrier *Analysis of Landscape:* elevation and relief; four main types of landscape; general characteristics of mountains and of plains	2, 10, 11, 15, 16
8	Social Studies	*American History:* the Twenties; the Great Depression; the dust bowl; understanding geographical factors—location, climate, topography, natural resources	7, 11, 13, 15, 16
HS	Social Studies	*American History:* U.S. since 1945—"Problems of an Affluent Society"; understanding geographical factors—location, climate, topography, natural resources	5, 8, 9, 11–16
		Economics: the study of how people try to satisfy their wants by getting the most out of their limited resources	8, 9, 12–14
	Science	*Earth Science:* basic rock types; basic knowledge concerning causes and results of weathering and erosion as destructive forces; basic knowledge concerning causes and results of Vulcanism and Diastrophism; knowledge of the atmosphere, its composition and anatomy; weather and climate	10–13, 15, 16
		Biology I—Ecology: populations; ecosystems; man's role	1–3, 5–8
		Consumer Biology—Ecology.	3, 9
		Environmental Science: food chains/food webs; interrelationship of living things; succession on land; overpopulation; air pollution; endangered species; communities	1–9, 14, 15
		Terrestial Ecology: ecological concepts of populations	7, 8
		Applied Chemistry: graphing	

RESOURCES

Aeschliman, Wendy. *Man, Nature, and Trash*. Albuquerque, NM: Albuquerque/Bernalillo County League of Women Voters. (Filmstrip. Also available through APS Environmental Education Department.)

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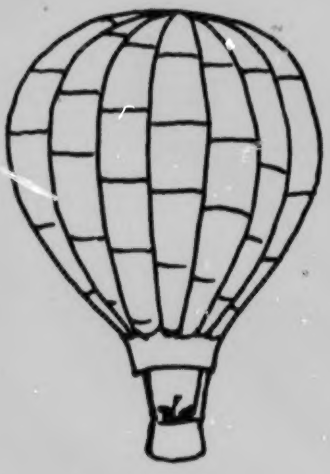


> "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."
>
> Aldo Leopold, *Sand County Almanac*

EYE-OPENER WORKSHEET 1: GETTING TO KNOW A HABITAT

Although you cannot really get to know a habitat unless you return to it frequently, there is much you can learn in one visit by careful observation. Use this worksheet to help you record your observations.

Name of Site: ______________________________ Date: ______________

Location: (city) __________________________ (county) ________________

Size of Area: __________________ Boundaries: ______________________

______________________________ Altitude: ______________ (m)

Where there is a choice of descriptions in the features listed below, circle the one which best describes the site.

Weather:

Aspect — winter, early spring, late spring, early summer, midsummer, late summer, early fall, late fall

Condition — sunny, cloudy, rainy, snowy, windy

Temperature — ______ (C)

- What was the weather like in the city of Albuquerque at the time? ______________
- If it was different from the weather at the site, what would account for it?
  ____
- Are there any signs of recent rain or snow in the area? ______________
- What is the average annual precipitation for that area? ______________
- How much of this precipitation is snow and how much is rain? ______________

Habitat Type:

forest — young; mature; recently lumbered; recently burned; considerable windfall damage; evergreen; summer green (deciduous); mixed

thicket — low shrubs; tall shrubs; tall shrubs and few trees

field — cultivated cropland; pioneer weed community with annual plants predominating; lowland meadow; upland meadow with perennial grasses and herbs predominating; permanent pasture; unkept pasture with scattered trees and shrubs; old field reverting to thicket or forest marsh; riparian woodland

Landform:

mountain, mesa, plain, canyon, valley, arroyo, bosque, hill

Slope:

facing direction — N NE E SE S SW W NW

degree — nearly level (0°–3°); gentle (3°–8°); moderate (8°–15°); steep (15°–25°); very steep (25°–35°)

Soil Type:

____

fertility — high, moderate, fairly low, very low

drainage — excessive, excellent, good, imperfect, very poor, permanently wet

Erosion:

little or none, moderate sheet erosion, occasional gullies, severe erosion, deeply gullied, subsoil exposed

Light Intensity:

______________ at ____________ o'clock. Device used for measuring ______________

Plants and Animals:

List the animals seen and plants identified. Record any animal signs observed (droppings, tracks, nests, etc.). How do abiotic conditions influence the kinds of plants and animals found?

ACTIVITIES

Eye-Opener Activities

1. Conduct a field trip to a natural area and look for ecological plant succession. Keep a record of the stages observed and indicate their order in the succession pattern of the particular habitat.
   - What are the **pioneer** organisms for this community?
   - How does any one stage make conditions unfavorable for itself and favorable for the next stage?
   - What are the dominant species observed? How will this habitat look when the **climax community** is reached? What events could take place which would prevent this from happening?
2. Draw a map of the Sandias showing the four life zones. On a map of North America, show the location of these same four zones.
   - What is a life zone? What factors determine the plant and animal life in these zones?
   - What is the general relationship between altitude and latitude in life zone changes?
3. Examine a rotting log or a pile of leaf litter. Look for evidence to explain how the waste disposal system operates in a natural community.
   - What other examples of **recycling** can be found in a natural community?
   - How is waste from the human community disposed of in Albuquerque? How much recycling is done?
   - Which system is more efficient in its waste disposal, the natural or the human? Explain.
   - What can citizens do to increase the amount of recovery and recycling of solid waste?
4. Using words or diagrams, explain how a forest animal gets water. How does a forest plant get water?
   - What would happen if the forest animals or plants were placed in a desert? What adaptations would they need to survive?
   - What problems arise when people try to grow non-indigenous plants in their gardens?
   - What kind of system could a person design to get water for himself in a forest? In a desert?
5. Conduct field trips using the basic Forest Service Field Investigation Task Cards for Forest Environment, Range Environment, Water Quality, or Soil in Land Use Planning.
6. Walk through a habitat and look for three samples of the "Abiotic/Biotic/Cultural Triangle." In each case show the interrelationships between the **abiotic** (physical) factors, the biotic (plants and animals), and the **cultural** (human actions). (See Section III, pages 53–58)

Additional Activities

7. For each of the local area habitats below, name the mini-environment(s) (p. 12) it encompasses. Then, match the plants and animals from the list with the local areas in which they are most likely to be found.

Area	Mini Environment(s)	Plants	Animals
Juan Tabo Picnic Area			
Doc Long's Picnic Area			
APS Outdoor Education Center			
Petroglyph State Park			
Oxbow			
Rio Grande Nature Center (Candelaria Farms)			

Plants

ponderosa pine
pinon pine
winter fat
cholla
juniper
Russian olive
white fir
salt cedar
black grama grass
alkali sacaton
Douglas fir

cattails
Russian thistle
scrub oak
prickly pear
mountain mohogany
cottonwood
yucca
snakeweed
sagebrush
salt grass

Animals

bighorn sheep
coyote
gopher
duck
ground squirrel
Steller's jay
scrub jay
mountain lion
antelope
hawk
scorpion
Norway rat
amphibians

prairie dog
quail
roadrunner
mule deer
rattlesnake
lizard
turkey
bobcat
kangaroo rat
muskrat
shorebirds
mice

- Construct **food chains** for each area to show how **energy** is transferred.
- Which organisms in the food chains are **producers**? Which are **primary consumers**? **Secondary consumers**? . . . Top level consumers? . . . **Scavengers**?
- What factors in a habitat influence which plants and animals can live there?
- What characteristics of each of the plants and animals in the above lists equip them for the habitats to which they were assigned?
- What environmental changes might occur which could kill the plants or animals, or drive the animals away? What could be done to prevent these changes?
- What animals and plants in the Sandias are considered endangered? What, if anything, is being done about these endangered species?

8. Conduct a panel discussion on the topic of **predator** control.
   - What animals are considered undesirable by some farmers and ranchers, and are sometimes controlled by a bounty?
   - What role do coyotes, mountain lions, and snakes play in maintaining stable and balanced communities?
   - How is the mule deer **population** in the Sandias determined? What natural controls of the mule deer exist in the Sandias? How do people control the mule deer population? What is the carrying capacity of the Sandias for mule deer? What would be the result of permitting the mule deer population to get out of control?
9. Contact the Forest Service for information on the various responsibilities they have for the management of the Sandia Mountains.
   - What are the main issues Forest Service must decide?
   - What is "**clearcutting**?" What arguments can be presented for and against it?
   - What arguments were advanced for and against the proposal to designate parts of the Sandias as "wilderness" areas? What positions did ranchers take? . . . environmentalists? Why? Defend one position.
   - Forest rangers do not share the public's blanket concern about fires. Explain.
   - What percentage of forest fires are natural? What percentage are caused by man?
   - What role does fire play in plant succession?
   - What other beneficial functions do fires perform? Under what circumstances does the Forest Service permit a fire to burn?
10. Construct a timeline of Albuquerque's geological history.
    - What did the Albuquerque area look like before the mountains were formed? How were the mountains formed? How were the mesas and arroyos formed?
    - Is the trough-shaped area between the mountains and the west mesa more correctly termed a "rift" or a "valley?" Why? What is the "inner valley?" How was it formed?
    - Why might the dates given for major steps in Albuquerque's geological history differ in various reference books?
11. Construct a three-dimensional table-model display of Albuquerque showing its various landforms (mesas, alluvial fans, mountains, valley, arroyos, canyons). Bring in samples of rocks found around the city and its environs. Place them on appropriate parts of the model.
    - In general, what kind of rocks are found in the Northeast Heights? . . . the West Mesa? . . . on the **escarpment** near the volcanoes . . . in the inner valley? In each case, where did the rocks originate? How did they get to their present location?
    - What kinds of igneous, sedimentary, and metamorphic rocks are found around Albuquerque?
    - Where is limestone most apt to be found? Granite? Lava and cinders?
    - In what kinds of rocks are fossils found? How are fossils formed?
    - What is alluvial fill?
    - What is meant by the "Great Unconformity?"
12. Using a map of the Rio Grande basin from the Jemez mountains to Socorro, indicate the possible sites of future **geothermal** plants.
    - What geological conditions are necessary to obtain geothermal energy? What are "tectonic plates?" What is the Rio Grande rift?" What evidence can you present to defend or dispute the prevalent theory about the rift's origin?
    - What process is used to obtain geothermal energy? What possible dangers are associated with the production of geothermal energy?
    - If Albuquerqueans were called upon to vote about locating a geothermal plant in the vicinity of the city, what position would you take? Why?

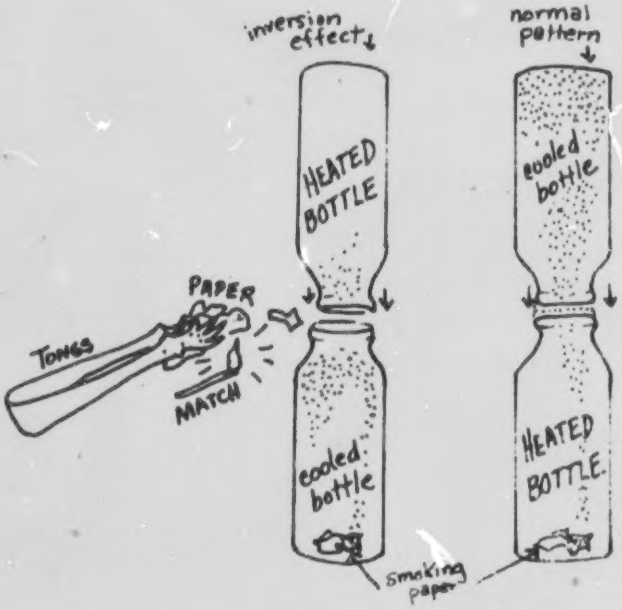
13. Use the "base map" technique to determine which areas in and around Albuquerque are most and least suited to urbanization. Prepare a transparency of the political boundaries and major landforms over the base map. Use other overlays to show sources of water, soil conditions, slope, flood plains, and areas subject to flooding.

    - To what extent is land which is well-suited for agriculture now being used for other purposes?
    - What areas are best-suited for home or commercial construction? Which are least-suited? Explain.
    - How much of the city is built on land which is susceptible to flooding? What steps have been taken to prevent further development in flood-prone areas?

14. Conduct a cost/benefit analysis of the environmental and economic impact of the Ideal Cement Company in Tijeras upon its immediate neighborhood and upon the Albuquerque area. After studying the data, set up a panel of students with differing viewpoints to discuss the pros and cons of this industry in relationship to the community's well-being.

    - What is quarried at Ideal Cement Company? Where are the gypsum and coal used in the manufacturing process obtained? How are they transported to Tijeras?
    - What environmental impacts does the plant have? What effect, if any, does the dust have on the health of the workers? . . . of residents in Tijeras? What other potential pollutants may be emitted?
    - What action is taken by the plant to reduce the dust? . . . the gaseous pollutants emitted? What problems are associated with revegetation of the disturbed land?
    - How does the community benefit from the company's economic gains? What portion of these gains are returned directly or indirectly to Albuquerque? How many local people are employed by Ideal Cement?
    - In what ways could Ideal Cement further reduce its effect on the immediate environment? What would be the economic consequences of these anti-pollution measures?

15. Demonstrate thermal inversion by using four milk bottles as shown in the diagram below.



Chill two bottles by placing them in refrigerator or shady spot outdoors on a cold day. Warm two bottles by placing them in hot sun or in a warm place in the house. Then, use them in the manner illustrated at the left.

- What is thermal inversion? How does the milk bottle experiment demonstrate the causes of thermal inversion?
- At what times of the year do the thermal inversions usually occur? Why?
- In what parts of the city? Why?
- Are thermal inversions, in themselves, hazardous? Explain.
- Based on data obtainable from Albuquerque's Environmental Health Department and the Weather Bureau, what is the probability of having a combination of thermal inversion, stable weather, and highly polluted air sufficient to exceed air quality standards as set by Albuquerque/Bernalillo County Air Quality Board?

- What role does the automobile play in causing air pollution in Albuquerque? What alternatives are there to the use of the automobile in Albuquerque?
- What action should the city take to cut back on the use of the private car? Why is it difficult to carry out this kind of action? How can the average citizen help?
- What can be the consequences in Albuquerque if population increases and automobile-use patterns do not change?

16. Collect and study weather maps for a week.
    - What is the jet stream? How does it influence weather?
    - What are millibars?
    - How can following the path of the jet stream and changes in the millibars for several days help to explain Albuquerque's climate?
17. Play "Stump the Experts." Set up a panel of "experts." Have the class mention ways in which man modifies his environment to meet his needs. Challenge the panel of experts to mention an animal adapted for that same condition. Example: Keeping warm in winter—polar bear's fur.

Activities for the Senses and Sensibilities

18. Working in small groups, write down descriptive or "mood" words which come to mind in any of the following situations:
    - walking in the bosque at the Rio Grande Nature Center
    - climbing the rocks at Juan Tabo Picnic area
    - picnicking at Doc Long's
    - standing in mid-Albuquerque and looking at the Sandias or the Volcanoes

    Use the words compiled by the group to write a poem in free verse. Share these poems with the other members of the group.
19. Sit quietly with closed eyes at the Rio Grande Nature Center or in the Sandias and listen to the "music" created by the natural things around you.
20. Select an animal whose movements appeal to you. Note its habitat, mannerisms, shape, feeding habits, and any other characteristics which make you want to simulate its movements. Let your body express how you feel. Select music to accompany your "dance."
21. Watch the changing colors of the Sandias during one day. Painting an abstract picture with the colors you like best and the colors of the sky, express the mood you associate with the mountains.
22. On a field trip to the mountains, mesa, or bosque, take time to make tactile discoveries. Feel a variety of smooth objects, rough objects, and textures somewhere between smooth and rough. Describe these textures any way but verbally . . . use bodily expression; graphic art forms such as rubbings, drawings, subtle washes of color, or sketches in clay; or use sounds.
23. React to joyful sensory experiences in the natural areas around Albuquerque by using a sense other than the one directly involved in the experience. Thus, respond to a beautiful view through body movement or through the use of mood words; express reactions to the sounds of nature by painting or drawing a picture; or, play music that expresses the majesty and power you see when you look at the mountains.
24. Use natural dyes such as onionskin, juniper, chamisa, and sage collected in open areas around the city to color yarn. Use these fibers to weave small rugs or mats. Check with the County Extension Agent before collecting to make sure none of the plants are endangered species.
25. Make collages of natural materials gathered in the mountains, on the mesa, or in the bosque. Create designs which reflect the mood of each of these areas. Check with the County Extension Agent before collecting.
26. Bring in natural clays of different colors and use them to make paints. Paint pictures with these locally-gathered materials. Find out about Indian paintings which use natural materials such as colored sand.
27. Using a "buddy" system, blindfold one person at a time, and take a "trust" walk. Have the blindfold partners describe differences in terrain and surfaces encountered on the walk, as well as any heightened awareness they may experience in the sense of smell, sound, or touch.

"The Indian view is that man is part of a delicately balanced universe in which all components—all life forms and natural elements—interrelate and interact with no part being more or less important than another. Further, it is believed that only man can upset this balance."

Tom Bahti

"Thou canst not stir a flower
without troubling a star."
Francis Thompson

Section II

ALBUQUERQUE'S HERITAGE AND HUMAN ENVIRONMENT

INTRODUCTION

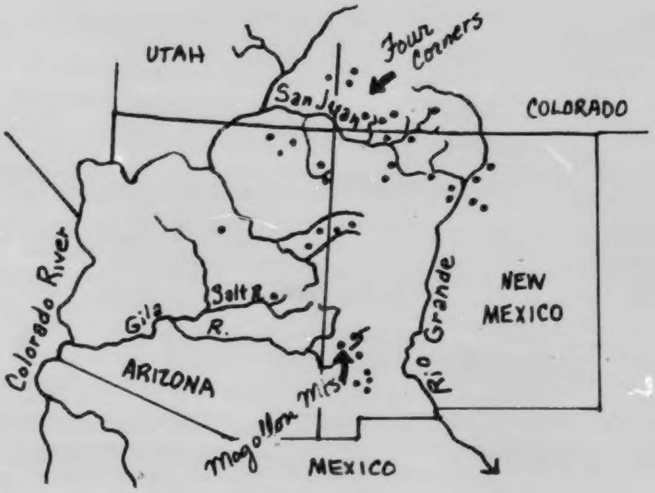
The human environment of Albuquerque is enriched by the diverse cultures and contributions of various subgroups: the Pueblo Indians whose ancestors have been in the region for many millenia; the Hispanic peoples who came to the area four centuries ago; and the Blacks and Anglos who are the most recent groups. The pictorial timeline below will serve to introduce the human history of the Albuquerque area which follows.

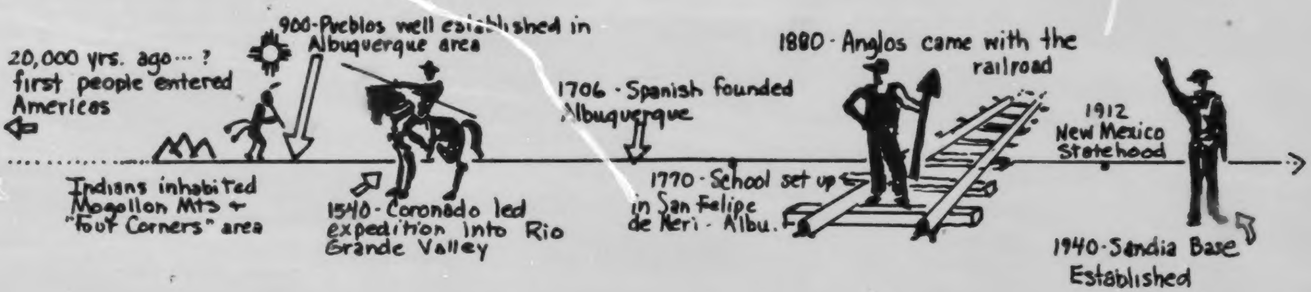
OUR PUEBLO NEIGHBORS

The Pueblo Indians of New Mexico and Arizona are descendants of the first people to enter the Americas, that entry being perhaps as many as 20,000 years ago. The Pueblo way of life, which is characterized by year-round village living and an economy based on cultivating corn, beans, and squash and supplemented by hunting and gathering, did not become well established in the Albuquerque area until about A.D. 900. Prior to that, the population centers of the Pueblo ancestors were at higher elevations either north (in the Four Corners area) or south (in the Mogollon Mountains) of Albuquerque. The Middle Rio Grande was not avoided, but density of population here was relatively low.

Two possibly associated reasons are generally cited for this. First, irrigated farming, using water from the Rio Grande, requires more labor expenditure than does relying on rainfall to water crops, and rainfall is greater at higher elevations. Second, prehistoric trade and communication networks centered along routes from Mexico along the Gila, Salt, and San Juan drainages which bypassed the Rio Grande.

Between about A.D. 1200 and 1540, population density in the Rio Grande Valley increased as both the Four Corners area and the Mogollon Mountains were abandoned. The reason for these abandonments is not clear. There is no evidence of a "great drought," or invasion of hostile nomadic Indians. It has been suggested that slightly more erratic rainfall patterns made support of high population densities increasingly untenable, and/or that the collapse of large political entities in Chihuahua, Mexico cut off the formerly important trade routes. In any case, all of the modern Pueblos have migration stories which relate accounts of abandoning former homes (for various reasons) and of founding their present villages. When the first expeditions of Spaniards reached New Mexico, Pueblo villages both along the Rio Grande and east of the Sandia and Manzano Mountains were far more numerous than they are today. The introduction of European diseases, horses, and firearms initiated the decimation of Native American populations, and the modern Pueblos reflect an adaptation in which an attempt has been made to incorporate traditional values and modes of life, while adjusting to the dislocations caused by the presence of first the Spaniards and later the United States citizens.


UTAH
Four Corners
San Juan R.
COLORADO
Colorado River
Salt R.
Gila R.
ARIZONA
NEW MEXICO
Rio Grande
Mogollon Mts
MEXICO

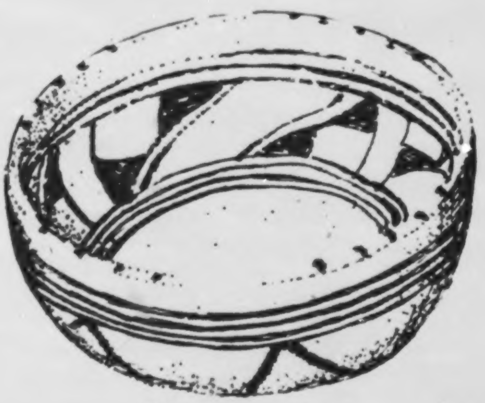

20,000 yrs. ago··· ? first people entered Americas
900-Pueblos well established in Albuquerque area
Indians inhabited Mogollon Mts + "Four Corners" area
1540-Coronado led expedition into Rio Grande Valley
1706 · Spanish founded Albuquerque
1770 · School set up in San Felipe de Neri - Albu.
1880 · Anglos came with the railroad
1912 New Mexico Statehood
1940 · Sandia Base Established

The Prehistoric Pueblo Adaptation

Corn (*Zea mays*) was the dietary staple and the presence of good agricultural land a necessary condition for the establishment of a village. Locations where the growing season is at least 120 days and where there is water for both crops and domestic use were selected. Prehistoric Puebloan agriculture relied on two techniques to insure a harvest. In cases where stream water could be diverted for crops, diversion ditches and canals were built. In the Sandias and Manzanos and to the east, farmers depended on rainfall, either directly or indirectly (through water captured in seeps or springs). A number of devices were used to conserve both soil and moisture: gravel mulch was applied to garden plots; terraces were built on slopes; and check dams were built across arroyos. Generally, the unpredictability of rainfall in any one location was dealt with by planting fields in several different topographic settings so that if a crop could not be obtained in one, it could be in another. Corn depletes nitrogen from the soil, but the Puebloans planted beans, which are nitrogen-fixing, in the same field. Squash was also grown; and where the growing season was long enough, cotton was planted as well. Agricultural tools consisted of wooden digging sticks and hoes of stone or animal bone.

Despite the relative sophistication of Pueblo agriculture, the desert environment is not particularly secure if one relies only on farming. Prehistoric Puebloans gathered a variety of wild plants which were incorporated in their diet. These included pinon nuts, Indian rice grass, chenopodium (goosefoot), cacti (especially prickly pear and cholla buds), amaranth seeds, hackberry, squawberry, serviceberry, chokecherry, and wild plum. Hunting was also important in that animal meat provided fat, as well as a source of protein other than beans. Traps and snares were used for small game such as pocket gophers, ground squirrels, and lizards. Bows and arrows were used for the larger game animals which included Rocky Mountain bighorn sheep, deer, antelope, and, where available, bison. Both cottontail and jackrabbits were hunted in drives conducted periodically throughout the year.

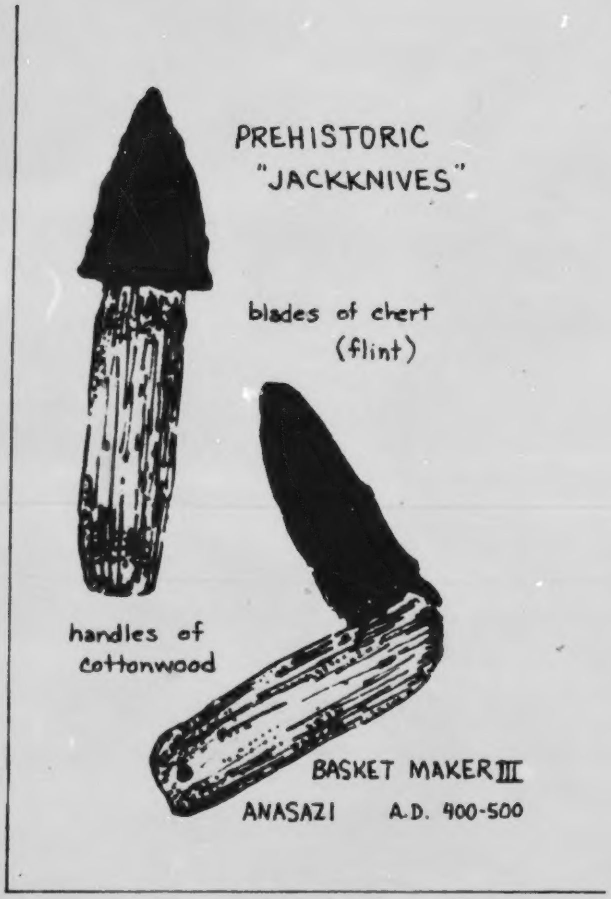
Equipment for food procurement and processing required a variety of raw materials. Wood was necessary for digging sticks and bows. Arrowheads, knives, and scrapers were made of cryptocrystaline rocks (such as obsidian, chert, and chalcedony) which could be shaped and re-sharpened by flaking. Sandstone, limestone, or basalt was used to make the grinding stones (manos and metates) used to process corn and wild seeds. Pottery jars and bowls were manufactured for cooking, storing, and serving food and water. Pottery-making required a source of fine clay and tempering material, which helped prevent shrinking and cracking of vessels. Sand, mica, schist and ground ceramic fragments were used as temper. Serving dishes were often decorated by painting prior to firing. Organic pigments, such as the black paint made from the Rocky Mountain bee plant, and mineral-based paints, such as the pigment made from hematite, were used. From about A.D. 1300 to the 1700's, Pueblo Indians in the central Rio Grande area used a glaze paint (produced by grinding up lead from local galena sources) to decorate serving bowls and jars.

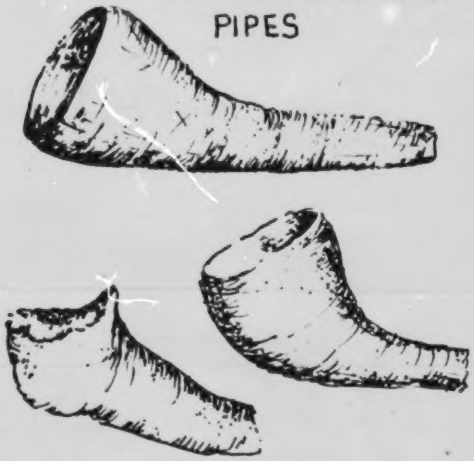


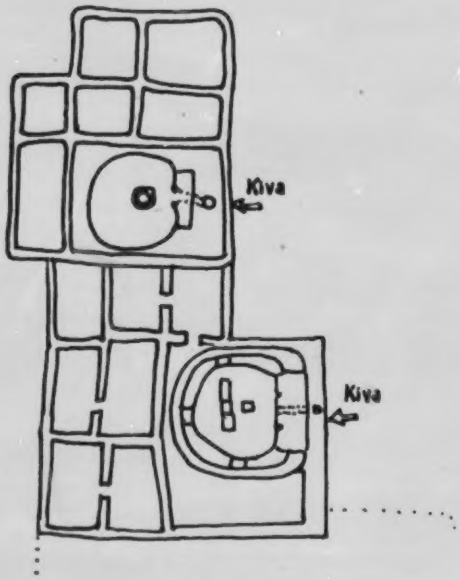
Bisquit ware
from the Rio Grande area

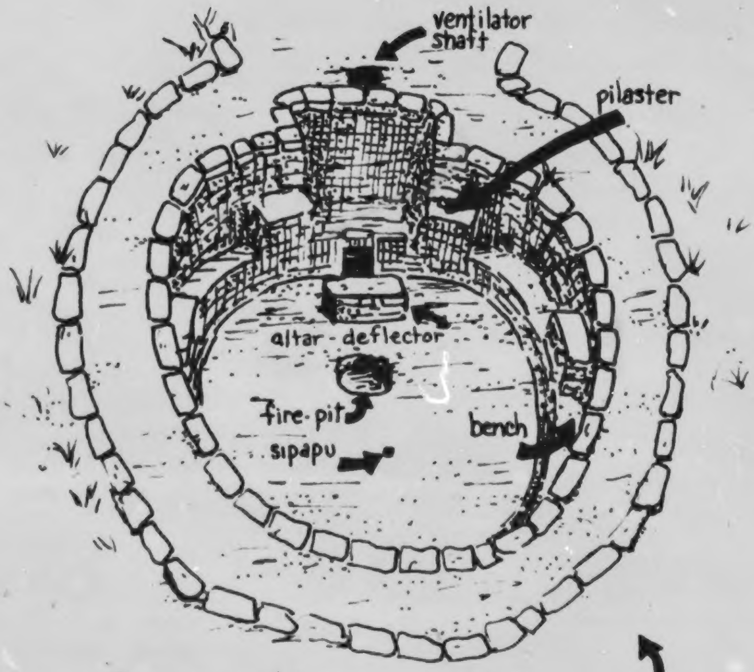
Some food, salt, and probably hides were traded among the villages. Pottery was widely traded as were turquoise and marine shell used for jewelry. Cotton and hides were used for clothing. Baskets made of reeds and yucca fiber were probably used for both winnowing and carrying. One of the most common tools used by the prehistoric Pueblos was a bone awl (usually made of deer or antelope bone) for basket weaving. Turkeys were kept by the people, probably both for their feathers and for meat. The only other domestic animal was the dog, apparently not used for food. A variety of birds were either hunted or captured, presumably for their feathers. These included hawks, owls, eagles, blue-birds, quail, doves, and waterfowl.

The group plans of prehistoric villages vary, but all include contiguous rectangular rooms (used for living rooms and storage); ceremonial rooms or **kivas** which were either rectangular and incorporated in blocks of living rooms or separate, semi-subterranean, circular rooms; plaza


PREHISTORIC
"JACKKNIVES"
blades of chert (flint)
handles of cottonwood
BASKET MAKER III
ANASAZI A.D. 400-500


POTTERY
TOBACCO-SMOKING
PIPES




ventilator shaft
pilaster
altar-deflector
fire-pit
bench
sipapu

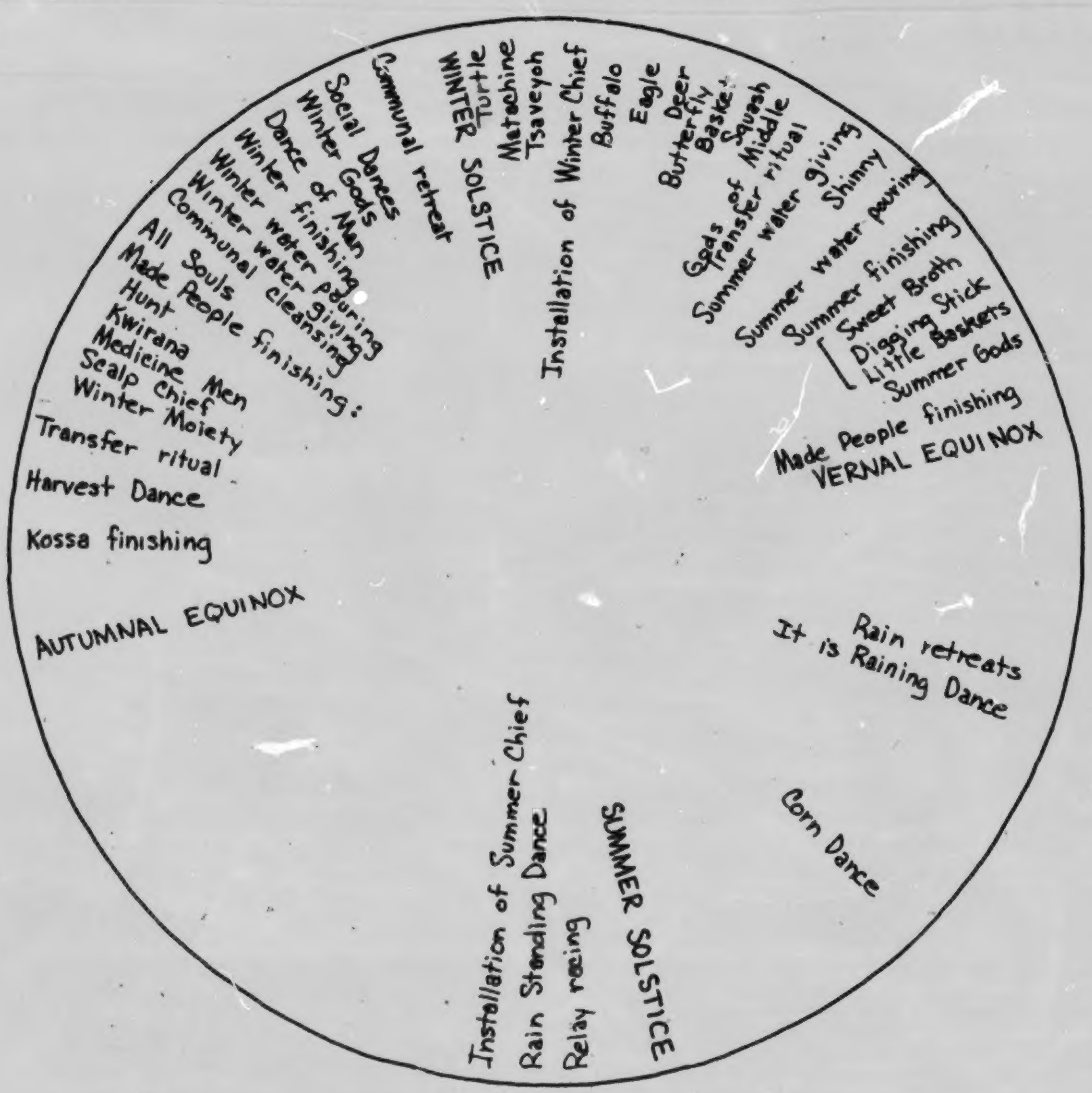
INTERIOR VIEW OF A KIVA ---

areas; and trash mounds. Rooms were constructed of either masonry set in adobe mortar or of coursed adobe (adobe bricks were introduced by Europeans). Timber was cut for vigas and latillas used to support flat adobe roofs. A great deal of timber must have been cut by each village for firewood which was necessary for both cooking and heat in winter. Stone axes of basalt or other hard stone were used.

The prehistoric Puebloans, like all other human beings, required food, water, shelter, the comfort of other human beings, and a sense of security in dealing with the natural environment. Without wheeled vehicles, trains or airplanes, telegraphs, telephones, radios, or writing, each individual had at once to be both master of several kinds of skills and also dependent upon other members of his community. Given the difficulties and uncertainties of obtaining a living in the semi-desert, tasks had to be done cooperatively according to schedule. Corn had to be planted before the rains and harvested before the frosts. If needed by man, nuts had to be gathered when ripe and not left for the squirrels and birds.

If one family's crops were destroyed, there had to be neighbors and kinsmen to whom they could turn. Access to the land and its products was acquired through ties of the family and village. Knowledge of how to treat the resources of the land had to have been learned from the experiences of other members of the community.

It should not be surprising that among the descendants of the ancient Pueblos, village harmony and respect for elders were important values. It has been noted that those aspects of life which are most problematic for a society are those most elaborated in ritual and religion. The prehistoric Pueblos elaborated themes dealing with water and rain to insure crops. Cloud blowers (pipes) produced smoke to simulate and attract clouds. Frogs, fish and snakes were painted on


Communal retreat
WINTER SOLSTICE
Turtle
Metachine
Tsaveyoh
Installation of Winter Chief
Buffalo
Eagle
Deer
Butterfly
Basket
Squash
Middle
of
Gods
Transfer ritual
Summer water giving
Shinny
Summer water pouring
Summer finishing
Sweet Broth
Digging Stick
Little Baskets
Summer Gods
Made People finishing
VERNAL EQUINOX
Rain retreats
It is Raining Dance
Corn Dance
SUMMER SOLSTICE
Relay racing
Rain Standing Dance
Installation of Summer Chief
AUTUMNAL EQUINOX
Kossa finishing
Harvest Dance
Transfer ritual
Winter Moiety
Scalp Chief
Medicine Men
Kwirana
Hunt
Made People finishing:
All Souls
Communal cleansing
Winter water giving
Winter water pouring
Winter finishing
Dance of Man
Winter Gods
Social Dances

THE RITUAL CALENDAR*

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ceramics and molded from clay. Shrines were often located in the mountains and near springs. The rain cloud motif was painted on seed jars and the walls of kivas. Certainly other aspects of prehistoric life such as curing disease and insuring success in hunting and warfare must also have involved considerable ritual (as they do among us all today), but tangible remains of these activities are not a marked feature of the archeological record.

Sandia and Isleta: Our Nearest Pueblo Neighbors

Sandia Pueblo, 14 miles north of Albuquerque on the east side of the Rio Grande, and Isleta Pueblo, 14 miles south of Albuquerque on the west side of the river, are both Tiwa-speaking Pueblos. Their native names are Nafiat (dusty) and Tuei (town). Sandia Pueblo lands comprise 22,884 acres, (93 km²) and the village itself seems to have been occupied continuously since about 1300. Isleta's lands consist of 187,826 acres (760 km²) and the present village site cannot be dated earlier than 1500. The core population of both villages is probably made up of descendants of Puebloan peoples living in the Rio Grande Valley long before European contact. Both Pueblos probably also received population increments from the now extinct Piro Pueblos which existed prior to conquest along the river south of Isleta and from the abandoned Saline Pueblos (Abo, Gran Quivera, and Quarai) of the Estancia Basin. In about 1880, Isleta welcomed and gave land to a group from Laguna Pueblo, a Kersean-speaking Pueblo. The immigrants have intermarried with the native Isletans.

The populations of both Sandia and Isleta have grown considerably since the turn of the century. In 1900, Sandia's population was just 74 persons. In 1968, this figure was 248. During the same period, Isleta grew from 989 to 2449 persons. At both villages, there has been recent trend toward building separate, "American-style" houses, closer to the highway than the older parts of town.

During prehistoric times, the inhabitants of both Pueblos derived their living from the land. Use of land for farming was in accordance with the traditions of each village. Land used for hunting, firewood gathering, and for its minerals or other materials was not "owned" in our legalistic sense, but used by the people as befitting their needs. Since each village acted as an independent political unit, it is likely that a great deal of effort was expended keeping land disputes or resource disputes between villages at a minimum, inasmuch as the only "solution" to an irresolvable conflict would be warfare. As soon as the first Europeans moved into New Mexico, problems over land ownership arose which were "settled" (and "resettled") legally in accordance with the policy of the government involved. During the period of Spain's control of New Mexico, Pueblo land was defined in terms of land grants from the King of Spain, and these lands could not be sold. During the period from 1821 to 1846 when Mexico ruled New Mexico, Pueblo land could be sold quite easily and Sandia Pueblo lost more than 21,000 acres (85 km²) of land in this manner. Finally, the United States Government has renegotiated Indian land claims. Under the terms of the Indian Reorganization Act of 1934, the Pueblos have been given considerable internal political autonomy. Since 1934, the Pueblos have acquired land through permit, lease, exchange, or purchase under a federal Land Acquisition Program.

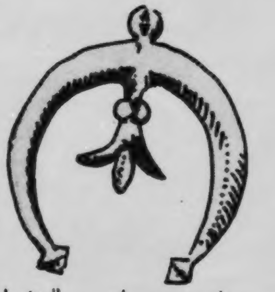
Clearly however, none of the Pueblos could be economically self-sufficient today given only their reservation lands. The residents of Sandia and Isleta continue to farm, but now have modern industrial equipment. Additional income to Isleta is gained through wage labor and through leasing tribal land for grazing or farming.

THE SPANISH PERIOD: 1540-1821
THE MEXICAN PERIOD: 1821-1846

Following the conquest of Mexico, Spanish explorers moved north into what is now New Mexico. Francisco Vasquez de Coronado led the first expedition into the Rio Grande Valley in 1540. Expeditions led by Francisco Sanchez Chumascado and Antonio de Espejo followed in 1581 and 1582. Permission to establish the first Spanish colony was given to Don Juan de Onate, and in 1598 he brought the first colonists to San Gabriel (near present day San Juan Pueblo). The provincial headquarters were moved to Santa Fe in 1610. In 1680, the Pueblo Indians revolted against the presence of the Spaniards and temporarily drove them from New Mexico. Don Antonio de Otermin attempted reconquest in the 1680's, but it was not until 1693 that Don Diego de Vargas retook Santa Fe. The Spanish system of government was established in New Mexico between 1693 and 1821. New Mexico became part of the Republic of Mexico in 1821, and officially part of the United States in 1846.

Thus, it is no accident that life in New Mexico reflects Spanish heritage to a greater extent than the English heritage characteristics of the eastern part of the country, since Spanish culture was dominant for a greater period of time. It is no wonder that enthusiasm for the United States Bicentennial in New Mexico was not overwhelming since many people of Hispanic descent could trace the New World history of their families back more than 300 years.

In order to understand the character of New Mexico during the period of Spanish domination, it is necessary to



"NAJA" with squash
blossom (pomegranate)

understand the civil and religious policies of Spain with respect to its colonies, as well as the cultural heritage of the Spaniards themselves. In the sixteenth century, Spain had only recently driven out the Moors, and in many ways, Spanish culture was a blend of Moorish and European elements. This blend, reflected in part in the Spanish language, was imported to Spanish colonies. Thus, the term adobe is derived from an Arabic verb "to conserve." The traditional Southwestern "squash blossom" necklace is a copy of the pomegranate flower which the Moors introduced to Spain, and which were frequently depicted on saddles. In parts of New Mexico, the doors of houses were painted blue, a traditional Arab way of warding off the "evil eye."

Colonial Spanish society was dominated by a caste system. At the top of the hierarchy were people who had been born in Spain (sometimes called **Gauchupines**). Most administrative officials belonged to this group. The **Creoles** were people of pure Spanish descent who had been born in the Americas. Creoles did not occupy the top administrative posts, but they dominated the Church and political bureaucracies, owned land and mines, and were often **Encomenderos.** (Under the **encomienda system,** the Spanish government gave the rights to Indian labor to colonists. Land was not part of the encomienda. Encomienda labor might be used for agricultural work or personal service to the Encomendero.) Below the creoles were **Mestizos**—people of mixed Indian, European, and often Negro descent. Mestizos were considered racially inferior, and although "free," they were usually without power. In Mexico, the system was so elaborate that 16 classes of Mestizos were distinguished. New Mexico, being on the fringe of things, had a more simplified system. Indians were to be brought into the Church and, in theory, should not have been slaves. African Blacks were imported and used as slaves in Mexico. In addition in New Mexico, "barbarous Indians" (those nomadic tribes who had not been baptized) were also enslaved. In terms of government, the Spanish system was not at all democratic. Power was in the hands of European-born Spaniards and the Creoles. The only democratic institution was the town council. Each village had its council of elder officials who were responsible largely for internal matters. Most of the Spanish colonists in New Mexico were Creoles or Mestizos. In addition, there was a class of people referred to as **Genizaros,** and membership in this class provided a minimal form of upward mobility for Indians and low class Mestizos.

Genizaros served as military personnel, protecting colonists and Pueblo Indians from attacks by nomadic Indians (who had, by this time, acquired the horse and were thus a real threat). Some Genizaros were captive "barbarous Indians," some were Pueblo Indians, and some were low class Mestizos. In reward for their military service, Genizaros were given land and homes in **barrios** within Spanish settlements or were given land to form their own Hispanic communities. The Genizaro communities were often strategically placed to protect Spanish Colonial administrative centers. Thus, the village of Carnue in Tijeras Canyon was a Genizaro community, guarding Albuquerque from potential Comanche raiders coming from the east. Belen was a Genizaro community guarding Albuquerque from the south. If such communities were successful and were not destroyed by raiders, the population lived an hispanicized way of life and considered themselves Spanish.

The second important arm of Spanish rule was the Church. In New Mexico, the Franciscans were responsible for missionary activity. Both the Franciscan practice of building churches and missions for Indians in Indian settlements and the encomienda system which legally prohibited the encomendero from living on his encomienda meant that Hispanic and Indian communities in New Mexico were spatially distinct.

According to Spanish policy, colonial land could not compete with Spain in commercial enterprises. Thus, colonials were prohibited from manufacturing wine, olive oil, and other items. Colonies were encouraged to develop mining, in order to supply Spain with silver and gold, and to develop agricultural activities. In New Mexico, mining was widespread, but ranching was the primary economic activity, with trade secondary.

The Founding of Albuquerque

Many Hispanic colonists settled in ranches along the Rio Grande between Puaray (now Coronado State Monument) and Isleta before the Pueblo Revolt. The area was referred to as the Rio Abajo, but was not an administrative unit. In 1706, following the re-conquest, Don Francisco Cuervo y Valdez, 28th colonial governor, founded an administrative unit or "Villa" which he named San Francisco De Alburquerque in honor of Don Francisco Fernandez de la Cueva Enriquez, Duque De Alburquerque, the 34th Viceroy of New Spain, and resident in Mexico City. The Viceroy, fearing the displeasure of King Philip V of Spain because the new "Villa" had not been authorized by him, changed the name to San Felipe De Alburquerque, in honor of the King. (The "r" in the first syllable was later dropped by Anglo-American colonists.) The new "Villa" was founded on the edge of meadows of the Rio Grande at a place where the river could be forded by oxcarts and near good pasturage and timber. The original settlement consisted of twelve families who had come from Bernalillo. The original settlement was in what is now Old Town.

The plan of Hispanic settlements, like Albuquerque, consisting of a Church and buildings arranged around a plaza in a rectangular or square formation, was decided by decree. This was for protection, a "stockade" against attacks by nomadic Indians or possibly against another rebellion on the part of the Pueblos. The church in Albuquerque, San Felipe de Neri, was built on the north side of the plaza (where it still stands) and was surrounded by a few public buildings and houses.

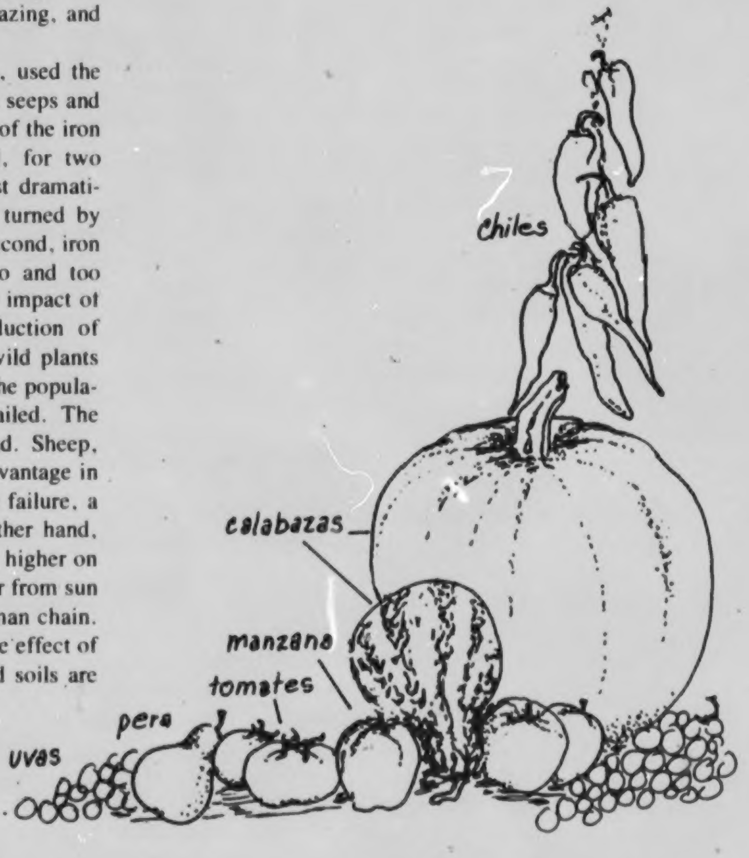
The economy of the Hispanos differed slightly from that

of their Pueblo neighbors. Like the Indians, the Spaniards cultivated corn, beans, and squash. They also introduced new crops: tomatoes and chile from Mexico; wheat, apples, pears, peaches, cantaloupe, watermelons, and grapes from Europe. In addition, they introduced livestock: chickens, sheep, goats, pigs, horses, oxen, and burros. Timber-cutting, for building, firewood, and clearing additional agricultural land, was rapid, and by 1820 it was necessary for the residents of Albuquerque to haul timber from as far away as 25 miles (40 km). Sheep thrived in New Mexico, and while weaving became an important activity, ground cover was destroyed in many places by over-grazing, and arroyo-cutting became a serious problem.

Hispanic settlers, like their Indian neighbors, used the waters of the Rio Grande for irrigation and used seeps and springs in the mountain settlements. The impact of the iron plow, known to the Spaniards, was minimal, for two reasons. First, plows increase productivity most dramatically in areas of heavy soils which cannot be turned by hand, and most desert soils are not that heavy. Second, iron for plows was scarce in colonial New Mexico and too expensive for most settlers to afford. The major impact of Hispanic subsistence activities was the introduction of domestic livestock. The Indians exploited the wild plants and animals of marginal land as food to protect the population against starvation in times when crops failed. The Hispanic farmers grazed sheep on marginal land. Sheep, and other domestic animals, are an economic advantage in that they are "living storage." In times of crop failure, a farmer can kill one or several sheep. On the other hand, sheep are more expensive than plant food. Being higher on the food chain, more energy is lost in the transfer from sun to plants to sheep to man than in the sun-plant-man chain. Probably more important is the long-term, erosive effect of sheep raising. In desert areas, plants which bind soils are scarce because of the lack of water.

Sheep, goats, and cows eat this minimal vegetation exposing soils to quite rapid erosion. The effects of erosion are not limited to land which is marginal for agriculture. As vegetation is lost, arroyos cut deeper and the water table in many areas may be permanently lowered. Overgrazing by Hispanos, white ranchers, and Indians has had an important longterm, deleterious effect on the New Mexican landscape. Domestic animals, particularly burros and oxen, introduced another change as well. This is the second most important area of the economy, trade. The Hispanic trade network was not very much larger than the Indian one. Few goods manufactured in Europe ever reached as far north as central New Mexico. On the other hand, burros and wagons made transport of much larger quantities of goods feasible. Goods traded south from Albuquerque included hides, tallow, surplus sheep and wool, some silver, and grain. In return, goods from Mexico included manufactured items (furniture, cloth, tools) and, when needed, food. It should be remembered that the Spaniards did not invest in road construction in New Mexico, and the overland route was long and difficult. It often took longer to travel from Mexico City to Santa Fe by burro than it did to travel from Mexico City to the Phillippines by ship.

During the Spanish Colonial period, New Mexico seems



to have walked an economic tightrope. Hispanic colonists greatly increased the local population. Domestic animals and more flow of trade goods only partially offset this. By 1800, the balance was precarious enough so that the population size of individual Indian communities was varying in response to rainfall patterns. (The same situation may have applied to Hispanic communities, but no one has studied them.) It was also during the Spanish period that raiding by nomadic Indians (Apaches and Comanches in the Albuquerque area) became a real problem. Many of the raiders were themselves displaced by movement of people caused by the presence of the French in the Mississippi Valley. The Europeans had also provided horses which facilitated the raiding activities.

In Hispanic Albuquerque, the Church, as well as the family, was an institution responsible for education. The first classrooms were in the parish house of San Felipe de Neri, which operated as a school from 1770. In 1772, the Fathers asked for and received $600 to establish the first free school in the town. Presumably only the very rich could afford to send their children to Mexico for further education.

Two problems which were to plague Albuquerque for years, waste disposal and flooding, began during the time of Spanish rule. The streets and ditches and the Rio Grande were generally used for dumping refuse and citizens complained about unsanitary conditions in the town. Flooding, which was worsened by the overgrazing, was a particular problem for people who depended upon moving goods by carts and wagons.

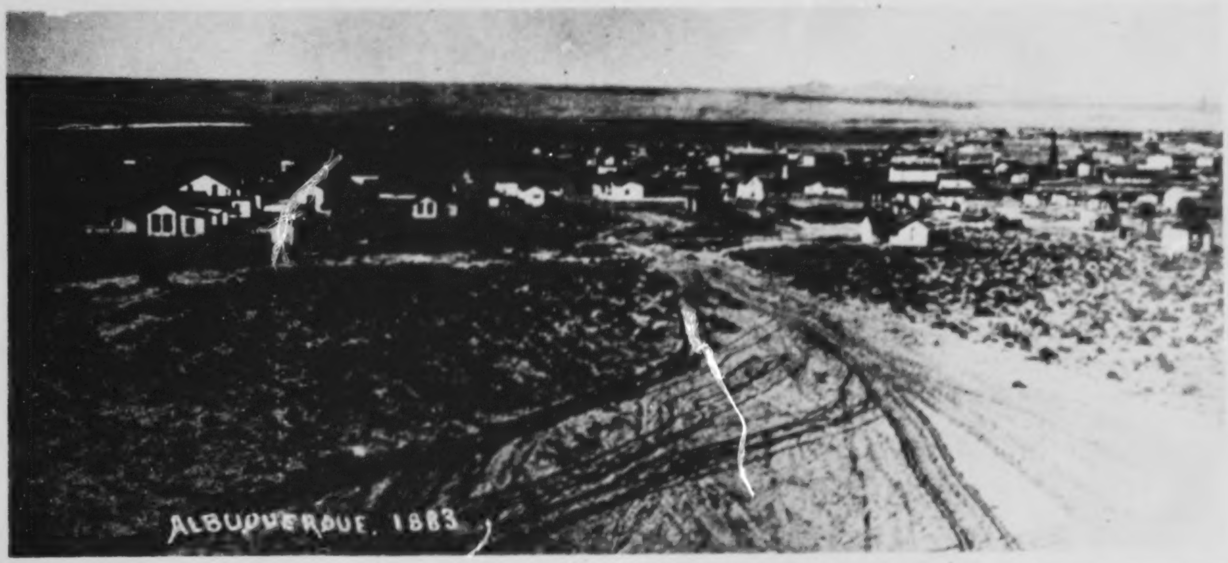
During the Hispanic period, Albuquerque did not seem destined to become the major city that it is now. Throughout the period, Bernalillo and Socorro were of about the same size, and, of course, Santa Fe was the most important center in the state. Whether or not Albuquerque could have lasted a very long time as a growing community under Spanish and later Mexican rule, is not known because the development of the town was essentially insured by the opening of the Santa Fe Trail and the migration of Anglos from the east. It would seem that at least initially, Albuquerque was saved, not by importing Anglo technology but by expanding its trade network to include the United States.

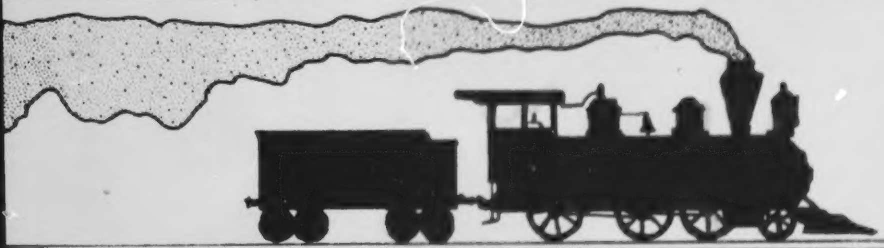
THE ANGLO PERIOD

Although Albuquerque became an official part of the United States in 1848 with General Stephen Watts Kearny's "conquest," most of the Anglo influence did not penetrate this remote region until after the Civil War. During the Civil War, there was a United States fort in Albuquerque, but the important battles took place elsewhere. At the end of the war, Albuquerque took on some of the appearance of the usual frontier towns; that is, the population now included some United States soldiers, Anglo businessmen (in the wagon train business), a few Anglo ranchers, and a more heterogeneous group of Indians. The town also supported the required new "service" industries, notably saloons and hotels. The major change for Albuquerque was the introduction of the Atlantic and Pacific Railway (later the Atchison, Topeka, and Santa Fe) in 1880. Actually, the fight over where to put the railway reflected the mood of the times. Many Albuquerque residents argued against having the railway, believing that it would hurt their investments in wagon transport. Others in the town saw the potential for new economic growth. The "solution" was, in fact, to bypass Albuquerque by a mile and establish New Albuquerque, at first merely a group of railway buildings at Railway (now Central Avenue) and First Streets. For years, New and Old Albuquerque were "connected" by a horsedrawn street car.

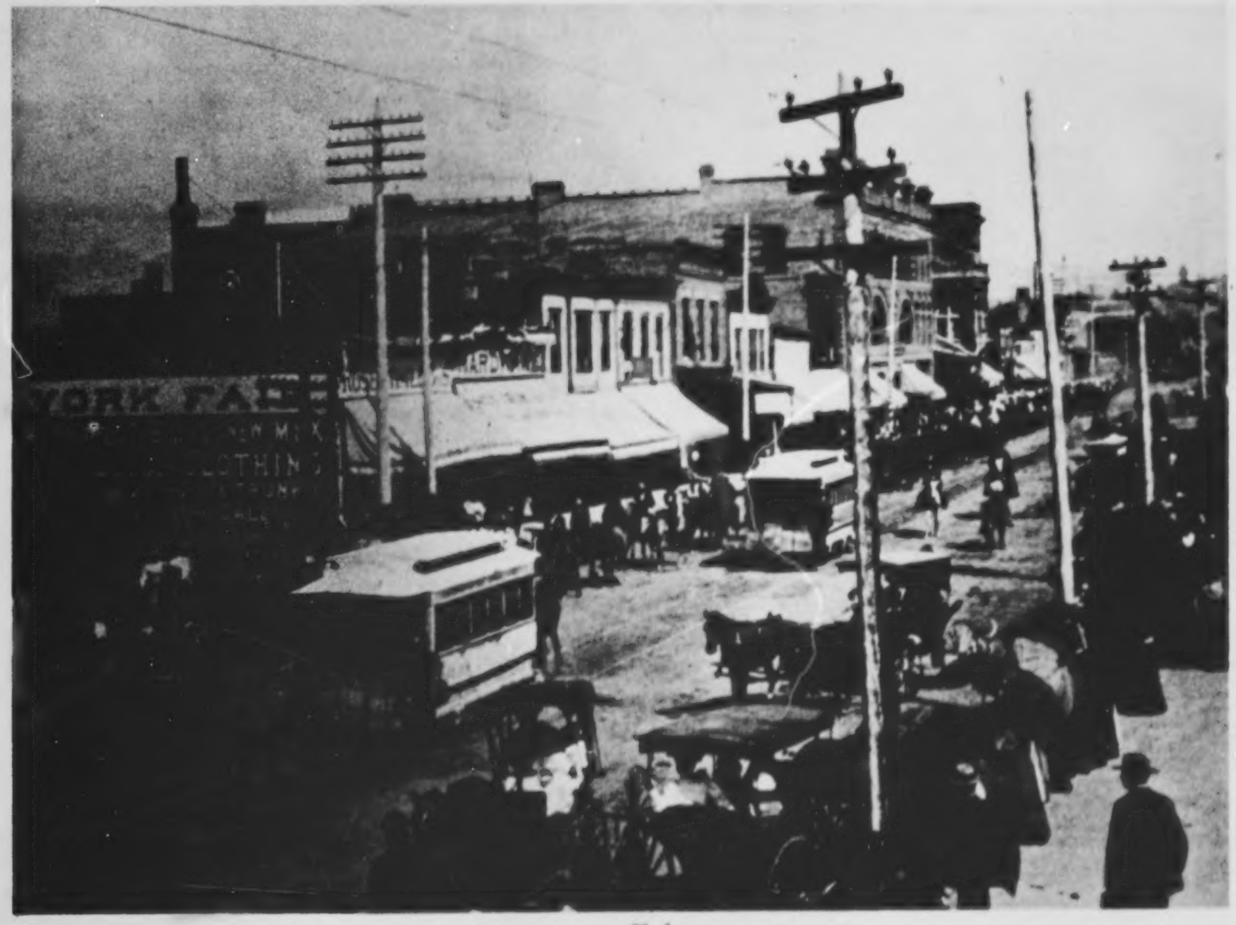
The railway provided access to a new market for Albuquerque's exports (Kansas City) and to materials from the east. Commercial plaster and window glass changed the appearance of Albuquerque's houses, but milled lumber was particularly sought after. The lumber was used in building construction, but especially for boardwalks. Flooding along Railway Avenue was so common that boardwalks and building entrances were built as much as five feet above ground level. The architectural style which emerged, called "New Mexico Territorial" was an odd blend of Hispanic and Anglo traditions. During the territorial period, and for sometime after Statehood, the "preferred" way of building was Anglo. Thus, the first buildings on the University of New Mexico campus were red brick and would not have been out of place in New York or Maryland.

Albuquerque grew rapidly during the Territorial Period. By 1900, the incorporated city contained 6,000 people, but the population was closer to 10,000 if the population in adjacent unincorporated communities was taken into consideration. The surge of growth is reflected particularly in two ways: citizens of Albuquerque were demanding better services; and companies sought franchises for profit whether or not they intended to provide adequate services. Records of city ordinances and council meetings show that between 1885 and 1890, the majority of ordinances related to the regulation of dance halls, gambling halls, and saloons. In addition, the first sewer unit was contracted for and completed in 1888; a volunteer fire department was organized in 1885; and in 1890, the city council set aside approximately $3,000 to build floodwater dikes. The dikes were not well-constructed and, in 1903, flooding was so severe that the Santa Fe Railway tracks and most of the business district were completely flooded. A number of accidents had occurred at the intersection of Coal and the Railway tracks, and after much citizen complaint, a viaduct over the tracks was constructed in 1900. Again, construction was shoddy, a great deal of city money was spent for constant repairs, and federal government inspectors declared it unfit in 1920. These problems were not unique to Albuquerque but rather characterize the growth of the country's frontier cities. As a counterbalance to the problems, incompetence, mismanagement and profiteering, Albuquerque had generous, public-minded citizens as well. Joshua Reynolds, for example, gave the city its first library in 1900. New Mexico was granted Statehood in 1912.


ALBUQUERQUE. 1883



1890 Loco and Tender
ATCHISON, TOPEKA AND SANTA FE


NEW MEX
CLOTHING

demonstrating its relatively rapid growth, and the new State institutions certainly had an impact on the character Albuquerque was to assume.

Albuquerque's clean air and high altitude was important to another aspect of the city's growth. In the first part of the 20th century, the city became a mecca for those suffering from tuberculosis. The sanitariums, most notably Presbyterian Hospital, were built on the outskirts of the city. The city eventually grew to encompass them. The provision of health services has been an important aspect of Albuquerque's economy. Further progress for the city, and its continued growth, were assured by the U.S. military with the establishment of Kirtland Air Force Base and Sandia Laboratories and Base. In the latter case, it was the relative obscurity of New Mexico (and therefore its strategic safety) that lead to the establishment of the facility at Los Alamos during the Second World War. Because the railroad (necessary for the transport of equipment and troops) was in Albuquerque, the activities involved in creating and maintaining Los Alamos had tremendous impact on the growth of Albuquerque, and it was the economy of war which pushed Albuquerque into the sprawling urban center it is today.

Albuquerque is thriving today. There are hundreds of new shops, expensive shopping centers, vast apartment complexes and housing developments. It is important to consider what sustains Albuquerque, since it is not a manufacturing city, nor does it have any coal or steel mills. Albuquerque is still, to a large extent, supported by the presence of the military, which depends on the United States Government and not on any resources indigenous to New Mexico. Albuquerque is still a transportation center as well. The railway is still important, but has to some extent been eclipsed by the airport and Interstate Highway System. (Note that Interstates 25 and 40 intersect in Albuquerque).

What would be the impact upon the city if the military bases in the area were to be abandoned? Certainly there would be a local economic depression, but the city would probably survive. As fuel resources become increasingly scarce, the large coal deposits of northwestern New Mexico and the uraniam deposits in the northern portion of the state will be tapped, and Albuquerque will be important in the intermediate storage and transhipment of these materials. Whether coal gasification becomes a viable economic alternative for the United States may, in the short run, be determined by decisions reached by the OPEC (Organization of Petroleum Exporting Countries). The decision will affect Albuquerque. No longer is the fate of any one country, city, or village in that entity's own hands because there is no escape from the impact of worldwide economic and political realities. This fact suggests the importance of considering two ecological principles: **carrying capacity** and **Leibig's Law.**

Carrying capacity may be defined as the amount of living matter an area will support indefinitely. The Forest Service, for example, uses measures of carrying capacity to decide how much grazing it will permit on its land. Consider the applicability of this concept to humans. Clearly the resources available in Albuquerque could not support its current population since the city's needs exceed the carrying capacity of the land. However, human technology (in this case transportation systems) permits Albuquerque to tap the resources of other areas. Anthropologists generally modify the concept of carrying capacity to refer to the amount of living matter (generally people) that can be supported in a given area over a long period of time with a specified technology. Those of us living in the 20th century are, of course, aware that technology changes constantly, and carrying capacity loses much of its conceptual import. There are currently two schools of thought regarding technological change. One school, the neo-Malthusian, emphasizes the fact that life-supporting resources are limited. It argues that population will grow until carrying capacity is reached, and it will then decline until a new equilibrium is established. Carrying capacity itself is seen as a state of **dynamic equilibrium** but one with both theoretical and real limits. The other school of thought has derived from the work of the Scandanavian economist, Esther Boserup. Boserup argues that population pressure is the independent variable; i.e., it is population growth which determines technological change. In the expanded version of Boserup's view, population pressure will always drive people to technological change which will support the expanded population. She also notes that technological change (particularly in agricultural systems) is toward increased output per unit of land, but with increased input of energy (first human, then animal, and finally machine). The picture is not a bright one. The notion is that people will work harder and life may well be less pleasant for individuals, but increased numbers will be supported. Given present circumstances a situation which requires increasingly greater inputs of energy is sobering, to say the least.

Leibig's Law states that the number of individuals in an environment is limited by the amount of the scarcest element necessary to maintain life in that environment. For example, if corn requires nitrogen and if in a given area nitrogen is the most limited resource, then it is the amount of nitrogen alone which will ultimately determine the amount of corn. Can Leibig's Law be applied to a city like Albuquerque? What is our most limited resource? A case may be made for either water or fuel. While Albuquerque is not self-sufficient with respect to either of these, it need not be, given present technology. Perhaps one must consider the entire earth as the only reasonable system.

SUGGESTED INFUSABLE AREAS OF THE CURRICULUM

Grade	Subject Area	Topic	Activities
K-12	Art	Explore and describe the socio-cultural character in ethnic/geographic variations of environments; know and describe the historical evolution of types of architecture	
K-1	Social Studies	*Small Group Living:* family life in New Mexico; community activities of family and how they are influenced by climate; location and natural resources	1, 6–8, 11, 16
1	Science	*Organisms:* seeds and plants; growing plants; "inventing" habitats	5, 7, 8
2	Social Studies	*Community Living:* geography of Albuquerque; globe and map orientation—location of recreational areas and libraries, museums, etc.; climatic effect; economics—career awareness	1, 8
	Science	*Life Cycles:* plant life cycles; planting seeds	5
3	Social Studies	*Rural and Urban Living:* comparative study of cultures—conservation of natural resources; recreation	1, 4, 5, 7, 8, 11, 14–18
	Science	*Populations*	12
4	Social Studies	*An Expanding World:* general knowledge of land forms and locations; interrelationship between way people make a living and effect on the land (past and present); climate—reasons for settling	7–11, 17, 18
	Science	*Environments:* "inventing" environmental factors; "inventing" environment	1, 4
5	Social Studies	*In the Americas:* location and use of specific landforms; history—westward movement, settlers	1, 2, 4, 5, 7–18
6	Social Studies	*Government and Technology:* current lifestyle—urban	2–4, 14, 16
		Roots: physical characteristics; "How have people of New Mexico utilized the physical environment?"; "How have people of New Mexico influenced each other?"; "How do the people of New Mexico live together today?"	2–4, 7, 9–11, 13, 14
	Science	*Ecosystems:* cycles in an ecosystem	8
		Middle School Science Curriculum: III. 1. a. Your Environment 5. c. Man's House 5. d. An Environmental Checklist 7. j. Can You Match It? IV. 1. f. Erosion Problems	1, 4, 7, 8, 14
7	Social Studies	*Universals—Social Traditions and Customs*	6, 10, 13, 14, 16, 17
		History of Geography: climate	1, 4
8	Social Studies	*American History:* influence of geography; meeting of cultures; advances of technology in the west; industrialization; domestic crisis	1–5, 7, 8, 12–14
HS	Social Studies	*Geography:* the study of the earth and the interaction of people with the earth	1, 5, 7, 8, 11, 14, 17, 18
		History of Minorities: culture; cultural values; cultural change	5, 6, 8, 13, 14
		Southwest History: the study of the unique, multi-cultural history of the Southwest region of the United States	5–10, 11, 14, 18

		American History: post Civil War—Great Plains; triumph of technology; traditional values vs. change; problems of an affluent society	2–5. 7–14
		Economics: the study of how people try to satisfy their wants by getting the most out of their limited resources	1. 7–9. 11. 14. 18
		Anthropology: cultural anthropology studies; how cultures work; principles that govern people's actions	1. 4. 6–8. 11. 13. 14
		Archaeology: the study of the lives and cultures of ancient peoples through the unearthing of their dwelling sites and examination of their physical and cultural remains	15–17
HS	Science	*Earth Science:* causes and results of weathering and erosion as destructive forces	7. 14
		Consumer Biology: children and ancestors	
		Environmental Science: soil conservation	7, 14

RESOURCES

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Wormington, H. M. *Prehistoric Indians of the Southwest*. Popular Series No. 17. Denver, CO: Denver Musuem of Natural History, 1961.

The Maxwell Museum of Anthropology provides traveling, documents, and "suitcase" exhibits on archeology, man in the Southwest, and native Southwest crafts. A film, *The Excavation of Tijeras Pueblo* (15 minutes, color), which describes both the way of life of prehistoric Pueblo people and the methods archeologists use to gather data is available at the Sandia Ranger Station and may be seen or borrowed from Maxwell Museum of Anthropology.

> "Civilizations leave marks on the earth by which they are known and judged. In large measure the nature of their immortality is gauged by how well their builders made peace with the environment."
>
> Nathaniel Alexander Owings

EYE-OPENER WORKSHEET 2: ALBUQUERQUE AS A PLACE TO LIVE

Answer the questions below. Compare your answers with those of your classmates.

- How long has your family lived in Albuquerque? ______________________________
- What part of the country or the world did your family come from? ______________________
- How many kilometers is it from Albuquerque to your family's former home? ________________
- Why did your family move to Albuquerque? (Check all answers which apply.)

  ______ to make a living

  ______ for someone's health

  ______ because of the climate

  ______ to be near relatives

  ______ there's more to do in Albuquerque

  ______ other reasons (Explain.) ______________

  ____

  ____

- Do you like living in Albuquerque? Yes No Yes and No
- List five things you like *most* about Albuquerque: Discuss the reasons for your answer with your classmates. What could happen to change these things?

  ____________________ ____________________ ____________________

  ____________________ ____________________

- List five things you like *least* about Albuquerque. Discuss the reasons for your answer with your classmates. What could happen to change these things?

  ____________________ ____________________ ____________________

  ____________________ ____________________

- List the things you like to do for fun. Next to each, check those you are able to do easily in Albuquerque:

  ( ) ________________ ( ) ________________ ( ) ________________

  ( ) ________________ ( ) ________________ ( ) ________________

- Check the places you have gone to. Circle those you especially liked.

  ______ Sandia Crest

  ______ Tingley Park

  ______ Coronado Monument

  ______ Doc Long picnic area

  ______ Juan Tabo picnic area

  ______ Petroglyph State Park

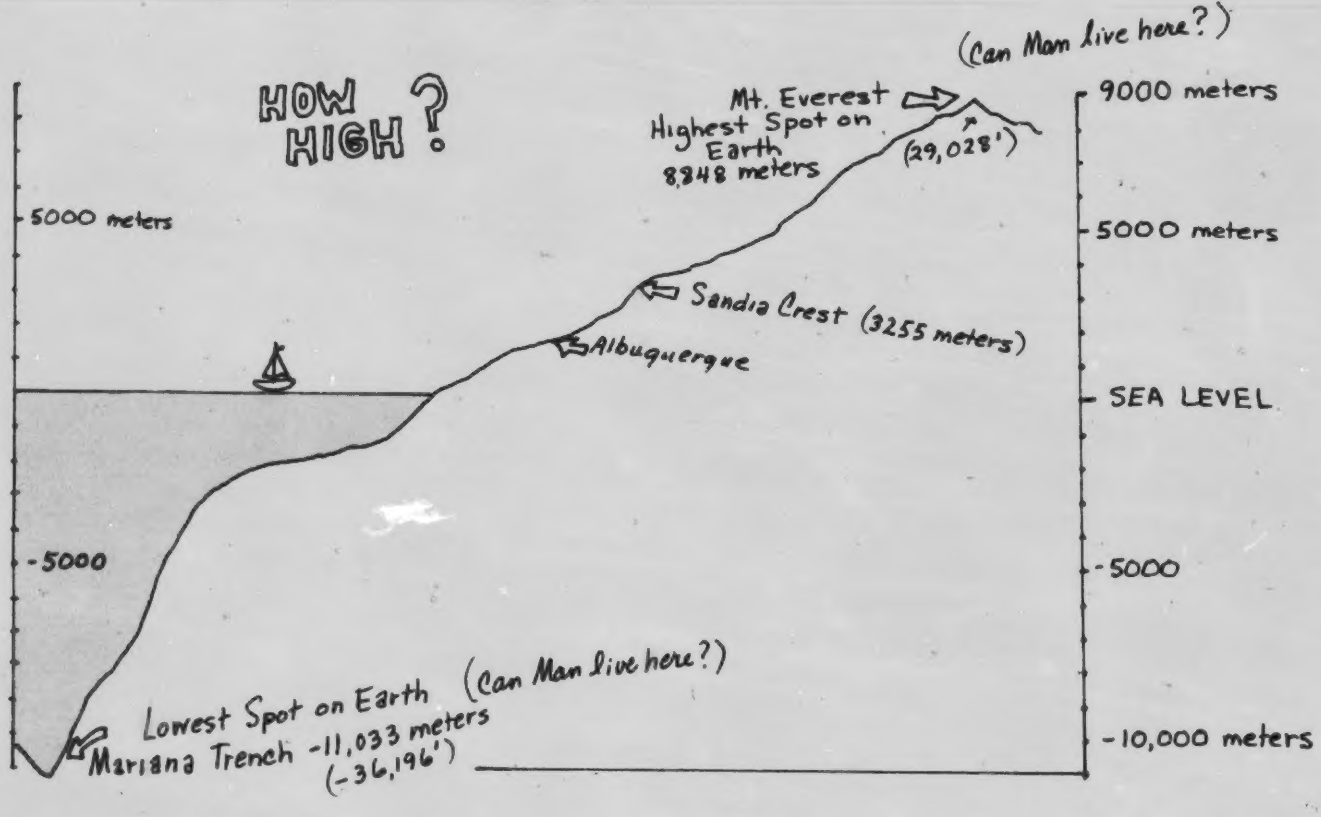
  If you had to share any of these places with hundreds of other people, how would you feel? Does that mean that only *you* should be allowed to go? Discuss.

- Pretend a friend from out of town wrote to ask your opinion about whether he and his family should move to Albuquerque. Write your answer on a separate sheet of paper.
- Answer this questionnaire pretending to be a Pueblo Indian in 1310; a Spaniard in 1706; a railroad builder in 1880; a Black in 1960; a retired Air Force officer in 1970.

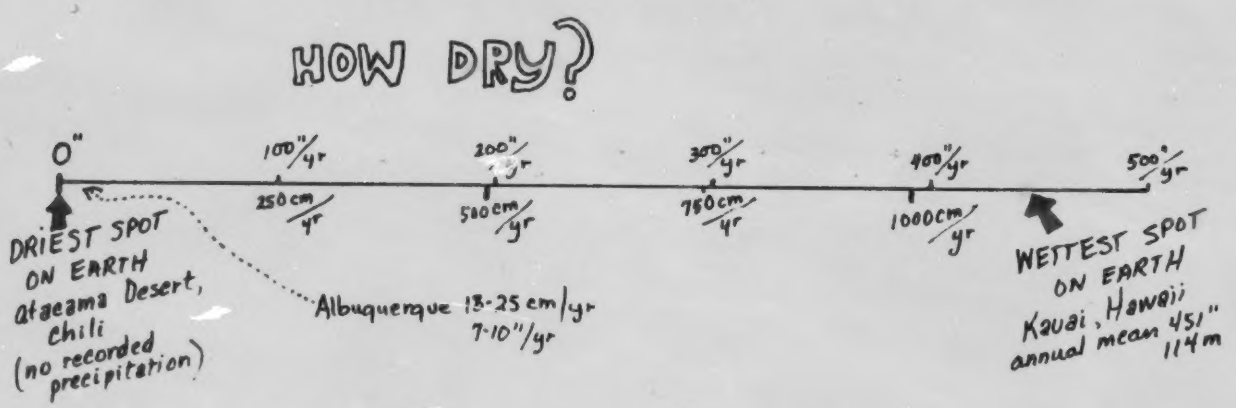
ACTIVITIES

Eye-Opener Activities

1. Select five places from which students' families (parents or ancestors) migrated to Albuquerque. Use parent interviews, maps, photographs, almanacs, and encyclopedias for information about altitude; proximity to water, amount of sunshine, rain, and snow; proximity to mountains; average January and July temperatures; and air quality.
   - Locate these five places on the drawing below.


HOW HIGH?
(Can Man live here?)
Mt. Everest
Highest Spot on Earth
8,848 meters
(29,028')
9000 meters
5000 meters
5000 meters
Sandia Crest (3255 meters)
Albuquerque
SEA LEVEL
-5000
-5000
(Can Man live here?)
Lowest Spot on Earth
Mariana Trench -11,033 meters
(-36,196')
-10,000 meters

- Again, locate these five places on this next illustration.


HOW DRY?
0"
100"/yr
200"/yr
300"/yr
400"/yr
500"/yr
250cm/yr
500cm/yr
750cm/yr
1000cm/yr
DRIEST SPOT ON EARTH
atacama Desert, chili
(no recorded precipitation)
Albuquerque 18-25 cm/yr
7-10"/yr
WETTEST SPOT ON EARTH
Kauai, Hawaii
annual mean 451"
114m

- How does Albuquerque compare with the other cities in the other aspects studied?
- What effect, if any, do these factors have on people's daily lives?
- How many students are satisfied with their physical environment in Albuquerque? How many are not? Why not? Conduct a poll in the class to find out.
- Which, if any, of these physical factors can people influence? How? Do Albuquerqueans exert any influence on these factors? If so, which?

2. Select 5 cities from which students' families have migrated to Albuquerque. Conduct research to find the following information: age of city; location; population; changes during past century; changes since World War II; present strengths and weaknesses.
   - Why were these cities' sites selected for settlement?
   - What are their major industries?
   - What are their present unemployment rates?
   - What financial problems do they have at present? What social problems?
   - What **demographic** changes occurred during the early part of the century? Since World War II? During the past decade? Explain.
   - How do these cities compare with Albuquerque in each of the factors under consideration? Discuss.
3. Select 5 cities from which students' families have migrated to Albuquerque. If possible, obtain classified and food "ads" from Sunday newspapers of each of these cities.
   - Which cities appear to offer the best job opportunities?
   - How comparable are salaries in these cities? Housing and food costs?
   - How does Albuquerque compare with these cities in these respects?
4. Which factors do students consider most important in selecting a place to live: jobs, climate, crime rate, cost of living, recreational opportunities, transportation, etc.?
   - Rate each one on a scale of 1–10 (1–little importance; 10–great importance)

     ex. job opportunities 1 ————————●————X———— 10
     climate
     etc. 1 ————————●———————— 10
   - What is a city? Construct a cardboard model of a city.
   - What are the advantages of a rural area? Of a city? Make a drawing or a painting showing personal feelings about a rural area; a city.
   - What are your personal preferences regarding climate?
   - How important do you consider a clean environment to be? What sacrifices would you make in order to have a clean environment?
   - To what extent does environmental quality affect people's lives?

Have students make posters and cartoons showing how pollution affects their lives and depicting what they will or must do to ensure a clean environment. Post their work conspicuously through the school.

Additional Activities

5. Keep a record of the school lunchroom menu for a week. Identify five or six of the most frequently used foods (corn, wheat, beef, etc.) for further study. Compile a chart similar to the one below. Visit a farmers' market to see which of these foods are currently grown locally.

Food	*Place of Origin*	*Introduction Into Our Diet*	*Major Current Source of the Product*	
			Albuquerque Area	*Elsewhere*
Wheat				
Corn				
Beef				

- Where was each of these plant and animal products first domesticated?
- How and when were these foods introduced into our diet? Use a world map to trace the routes.
- Which of these foods were grown by Indians in the early Pueblos? Which were grown by the Spanish settlers in New Mexico? Which are not grown in the Albuquerque area?
- What changes have taken place in agriculture in the Albuquerque area since World War II? Explain.
- How are the non-local foods shown on the chart transported to Albuquerque?
- What systems are involved in the transportation, storage, and distribution of foods which are not grown locally? What demands do these systems make on the energy supply?
- What effect would natural problems such as drought, or societal problems such as strikes and depression, have on the production, transportation, and distribution of these food products?
- What would be the effect(s) on these systems of a marked increase in Albuquerque's population?

6. Use boxes or papier mache to make models of Indian Pueblos and of contemporary apartment houses. Pueblos are often likened to apartment houses. Discuss similarities and differences between the two.
   - How are relationships among residents of Pueblos and of apartment houses similar? How are they different?
   - How are Pueblos very different economically from apartment houses?
   - What social systems and customs bind Indians of the same Pueblo to each other?
7. Prepare a chart comparing the effects on the land of Indian, Spanish, and Anglo agriculture.
   - How did the Indians' extensive planting of corn affect the soil?
   - How do bean crops affect the soil?
   - What effect did sheep grazing by the Spanish have on the land?
   - How have modern technological advances in farming affected the land?
8. Role play critical environmental/economic situations which affected Pueblo Indians in past centuries and some which affected Hispanic settlers: These should be situations which could affect residents of Albuquerque in the late 20th century. Compare the **"buffering" strategies** used by the Indians, the Spanish, and the Anglos.
   - What would Indians do when the corn crop failed?
   - How would Hispanic settlers cope with a drought?
   - How would contemporary Albuquerque cope with either a removal of the Air Force bases or a shutdown of the airport?
9. Frederick Jackson Turner suggested that the frontier "way of life played a large role in the development of American national character." Discuss the general characteristics of frontier communities.
   - How did these characteristics affect Albuquerque?

- What examples of "Yankee ingenuity" can be found in our city's development? "Self-reliance?" A democratic lifestyle?
- In general, what was the attitude of people of the "frontier" toward the environment? What effect did that attitude have on the environment? To what extent has that attitude been modified in Albuquerque recently?

10. Set up a display of photographs and maps of buildings and city streets of Old Town and Downtown Albuquerque.
    - How do these photographs and maps reflect the past and present uses of these two sections of the city?
    - Why is there a plaza in Old Town? Why is it rectangular?
    - Are the streets more regular in Old Town or Downtown? Why?
    - Why are streets wider in Downtown than in Old Town?
    - What changes have occurred in Downtown during the past decade or two? Why? What effect have these changes had on the city?
    - What plans are currently underway to revitalize Downtown? What are their chances for success? What factors might determine how viable Downtown can be? Develop a flowchart to show the effects a thriving Downtown would have on the city economically, socially, and environmentally.
11. Plot various Albuquerque and neighboring communities (Old Town, South Valley, Corrales, Sandia Pueblo) on a topographic map. Discuss what natural resources may have been important in the founding and growth of each community.
    - When was each community established?
    - How close to water for irrigation is each community?
    - How arable is the soil in each place?
    - How close is each community to major roads or railroads?
12. Construct line graphs to show Albuquerque's population by decades from 1860 to the present.

    A practical means of determining the rate of growth for a community would be to find the population figures for several consecutive years and separately calculate the difference (as a percentage) from year to year. The average of these annual percentages will provide a workable figure to be used in projecting growth.

    For example:

Year	*Population*	*Population Increase*	*Rate of Increase*
1973			
1974			
1975			
1976			
1977			

+ ____________

÷ 5 years =

Assuming that this average annual rate of population growth will remain the same, project what Albuquerque's population would be in 1980, 1990, 2000, and 2010.

- How long will it take for Albuquerque's population to be double its 1977 size? Use the equation below.

$$\frac{70}{\text{Annual Rate}} = \text{Number of years to double population}$$

- What was the rate of growth between 1860 and 1910? between 1910 and 1940? between 1940 and 1970? What is Albuquerque's current rate of growth? In each of these periods, what accounted for the rate of growth?
- What would the population of Albuquerque be by the year 2000 if the current rate of immigration doubles? What factors will determine what the rate of immigration will be during the remainder of this century?

- What might be some of the positive and negative consequences if the current rate of immigration doubled?
- How does Albuquerque's rate of growth compare with the rest of the state? With the nation?

13. Construct bar graphs showing the relative population of Indian, Hispanic, Blacks and Anglos in Albuquerque for the census periods from the time of Statehood (1912) until the present.
    - If there was a significant change in any decade, what events helped to bring about this change?
    - At these different stages in the city's history, which culture predominated? Should any one culture dominate simply because it has the largest population or because it is the oldest in the area? Explain.
    - How do people from the different groups view the same period in history?
    - How might the city's history and development have been different if another culture had been the dominant one at any stage in its growth? Describe one example.
14. Select committees for research and report on the importance of, and attitudes toward, water in the Indian Period. In the Spanish Period. In modern Albuquerque.
    - What part did water play in the selection of Albuquerque as a place to settle?
    - What problems (drought, flooding, erosion) were associated with water during each of these periods?
    - How did the inhabitants cope with drought? What role did religion play?
15. Divide the class in half. Have one group bury items in the school yard. Make sure that some of the items are small (loose beads, safety pins); some are relatively large (a bowl, a glass jar); some items are perishable (nuts, seeds, etc.) and others not. Have students make a complete record of what was buried and where. A week or so later, have the other group excavate the site.
    - How many items were lost?
    - Were items lost through careless excavation or through disintegration?
    - Did the excavators find out which items had been buried separately and which placed close together?
    - Discuss with the class the fact that all archeology is destructive. Once a site has been excavated there is nothing left. What burden is put upon the archeologists in terms of recording information?
16. Have the class examine waste baskets in the rooms of their houses and school. This is trash, which constitutes most of what archeologists recover from a site. Discuss what can be learned from these findings.
    - What is each of your rooms used for?
    - How many people live in the house?
    - What are the ages and sexes of the people in the house?
    - What are the occupations and religious preferences of the occupants?
    - How can the architecture (physical description) and the contents of the house help to answer these questions?
17. Look at photographs of excavated archeological sites. Discuss what can be learned from them.
    - How could the time the site was occupied be estimated?
    - How could the number of people living at the site be estimated?
    - Is it possible to tell how the people made a living? If so, what clues are in the photographs?
18. On a map of the Albuquerque region, locate Coronado State Monument, Tijeras Pueblo, Rancho De Carnue, Isleta, and Sandia.
    - What might have influenced selection of each of these locations as a place for settlement?
    - How do these different locations compare in their desirability as sites for settlements?
    - What is known about the reasons why some sites were abandoned?

Activities for the Senses and Sensibilities

19. Have students write a short essay on something (not a person) which they find beautiful, and then share their writings with the class.

    - Why do different students select different subjects?
    - What things do the Indian, the Hispanic, and the Anglo cultures find beautiful?
    - Which of the subjects written about could be destroyed by some outside force? How would the writer feel if the subject were destroyed?

20. Prepare a multi-media presentation which depicts the richness and diversity of Albuquerque's major cultures and its natural environment. This can be done by blending and "collaging" bits and pieces of music, art, poetry, designs based on patterns from nature, and sounds from nature. The finished product of images, sounds, shapes, and colors should embody and suggest the "mood" of Albuquerque's cultural and natural scene. Slide projectors, opaque projectors, 16 mm. projectors (using obsolete, bleached film), strobe lights, phonographs, tape recorders can be used in various combinations for effect.

21. Read the following quotations and discuss the questions below.

"With beauty before me, I walk.
With beauty behind me, I walk
With beauty below me, I walk
With beauty above me, I walk
It is finished (again) in beauty
It is finished in beauty
It is finished in beauty"

(From: *Navajo Night Chant*)

"Abide with me; fast falls the
eventide
The darkness deepens; Lord, with
me abide
When other helpers fail, and comforts
flee,
Help of the helpless, oh, abide
with me"

(From: *Abide With Me*, a hymn of
the Protestant Episcopal Church)

"Rain-makers, come out from all roads that great rivers may cover the earth;
That stones may be moved by the torrents . . .
Let our children live and be happy.
Send us the good south winds.
Send us your breath over the lakes, that our great world may be made beautiful and our peoples may live."

(From: Zuni invocation during the winter solstice)

"With the ways of the white man entering into our lives, perhaps it will not be long before our people become a wandering tribe, aimlessly roving the path of self-deterioration and destruction. But it is for our children to decide and work for. We cannot tell them of the way our people survived, for they would not believe us. We must just hope they, too, can survive what lies before them."

(From: *The Zuni's Self-Portrayals*, by the Zuni people)

Adios acompanamiento
Pues ya todo esta cumplido;
Ponganmen en la sepultura
En la tierra del olvido.

De la nada fui formado
Por obra de mi criador,
Y en el juicio eniversal
El sera mi defendor.

A Dios me postro humillado
De mi culpa arrepentido,
El que me a de perdonar
Por lo mal que le a servido.

En Dios espero reposo,
En Dios espero Consuelo,
De que en el juicio tremendo
Me abra las puertas del cielo

(From the last verses of *Adios al mundo*, an alabado reproduced in *Brothers of Light Brothers of Blood. The Penitentes of the Southwest* by Marta Weigle, 1976. U.N.M. Press, Albuquerque. It is also reproduced in *Brothers of Light: The Penitentes of the Southwest* by Alice Corbin Henderson, 1937, Harcourt, Brace, and Company, New York.)

- How do our poetry and our religious hymns express our values?
- How does each of us learn values?
- What values are expressed in the religious works above?
- What fears are expressed in the third quotation?
- How can the traditional holistic philosophy and the reverence for the universe felt by so many Native Americans be integrated into the realities of 20th century life?
- What effect is the "boom town" atmosphere of many uranium-mining New Mexico towns having on the beliefs and behavior of Indians in those towns?

22. Read aloud the passage from Frank Waters' *THE MAN WHO KILLED THE DEER** which reveals some of the thoughts of Rodolfo Byers, a white trader who lived among the Indians for thirty years:

> "What an appalling difference, really, between this race and his own which had supplanted it. No man knew what it was, because his vision of another, his vision of the life around them both, was compacted of the sum total of the very things which differentiated him from his fellow.
>
> Byers thought of the world of nature as the white man sees it: the sparkling streams and turbulent rivers as sources of potential electric power; the mountains gutted for the gold and silver to carry on the commerce of the world; the steel and iron and wood, cut and fashioned, smelted, wrought, and riveted from the earth to bridge with shining hulls the illimitable terrors of the seas—a resistless, inanimate world of nature to be used and refashioned at will by man in his magnificent and courageous folly to wrest a purpose from eternity. And yet, what did he really know of the enduring earth he scratched, the timeless seas he spanned, the unmindful stars winking at his puny efforts?
>
> And he thought of the world of nature as the Indian had always seen it. The whole world was animate—night and day, wind, cloud, trees, the young corn, all was alive and sentient. Of this universe man was as integral part. The beings about him were neither friendly or hostile, but harmonious parts of the whole. There was no Satan, no Christ, no antithesis between good and evil, between matter and spirit. The world was simply one living whole in which man dies, but mankind remains. How then can man be lord of the universe? The forests have not been given him to despoil. He is equal in importance to the mountain and the blade of grass, to the rabbit and the young corn plant. Therefore, if the life of one of these is to be used for his necessity, it must first be approached with reverence and permission obtained by ritual, and thus the balance of the whole maintained intact.
>
> What then is a pine, thought Byers, the potential mast of a ship, a life that stands and breathes and dies like man, or the craven image of a thought? What is the world we see? It is as each man sees it, and his vision is compounded of the tissues and blood-vessels of his eyes, and the blood that feeds them, and the nerves that lead into the nerve center of his brain, and the sensations that stimulate an image in his mind. And there alone it truly exists—in the mind of man which sees it as only he can see it, according to his conception of the life of which he is a part.
>
> So Byers looked at the wooden post and at the man who carved it, and knew that each saw there a different thing.
>
> The brotherhood of man! It will always be a dreary phrase, a futile hope until each man, all men, realize that they themselves are but different reflections and insubstantial images of a greater invisible whole.
>
> There are those who have eyes and cannot see, who have ears and cannot hear. They are blind and deaf, they have no tongues save for the barter of the day. For which of us now knows that awakened spirit of sleeping man by which he can see beyond the horizon, hear even the heart beating within the stone, and speak in silence those truths which are of us all?
>
> A means, a tongue, a bridge to span the wordless chasm that separates us all; it is the cry of every human heart."

*Reprint permission from Swallow Press

Section III

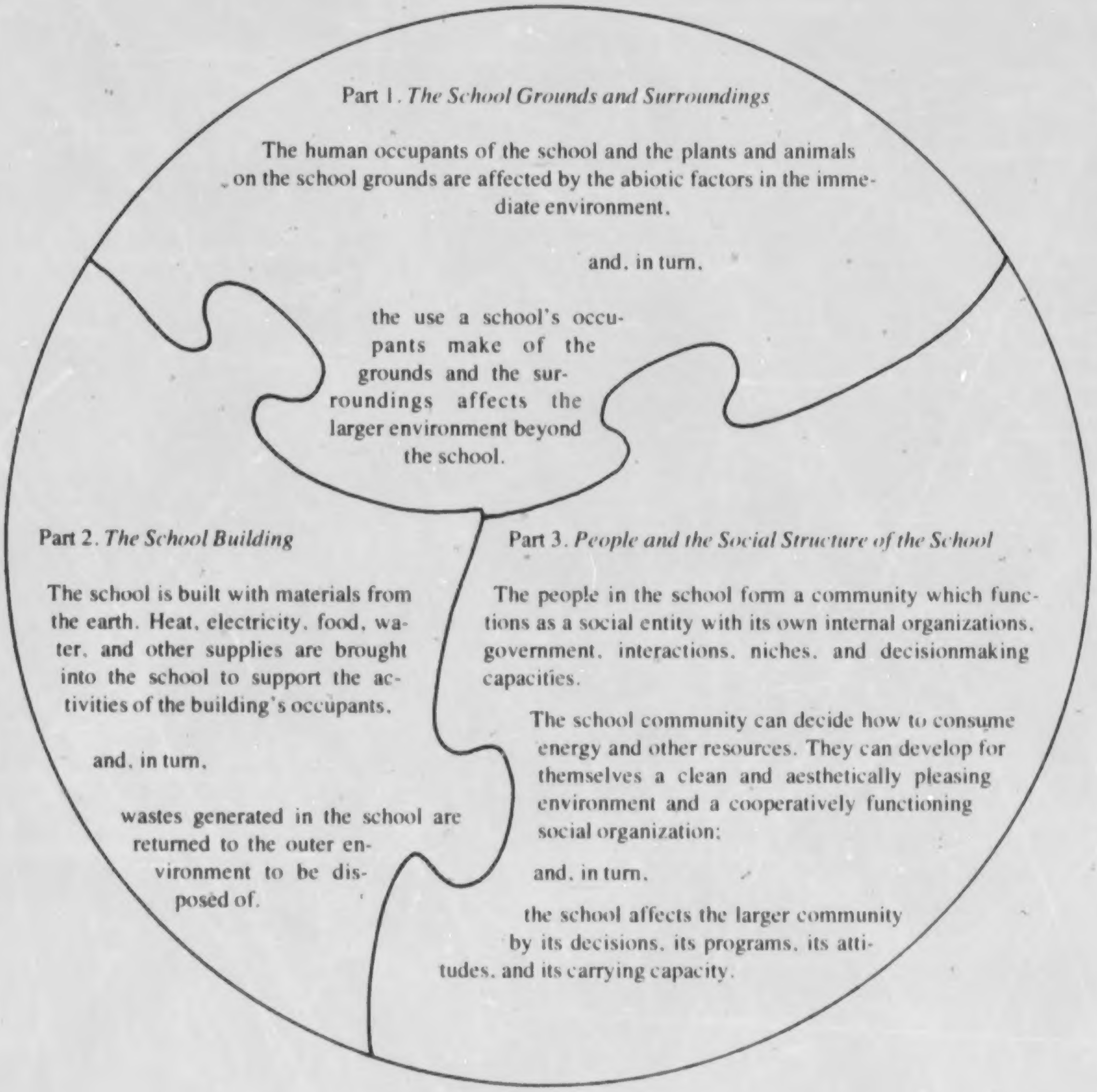
THE SCHOOL AND ITS COMMUNITY

INTRODUCTION: THE SCHOOL — A CITY IN MICROCOSM

The school, its grounds and surroundings, the building, and the people in it, form a microcosm which can provide insight into the workings of a matrix as complicated as the City of Albuquerque and the natural systems included in it. The flow of people, energy, goods, waste and the systems of paths, wires, pipes, and rules reflect those of the total community.

Using the school and its environs as a laboratory specimen and carefully dissecting it to see what makes it function, lead to identification of the same basic principles applicable to all environments — natural or manmade.

The school as a mini-environment, a self-contained ecosystem, interrelates with the outer world in an ongoing succession. In dealing with Parts 1, 2, and 3 of this section, the following considerations and their time frames might profitably be addressed as suggested as follows:



Part 1. *The School Grounds and Surroundings*

The human occupants of the school and the plants and animals on the school grounds are affected by the abiotic factors in the immediate environment.

and, in turn,

the use a school's occupants make of the grounds and the surroundings affects the larger environment beyond the school.

Part 2. *The School Building*

The school is built with materials from the earth. Heat, electricity, food, water, and other supplies are brought into the school to support the activities of the building's occupants.

and, in turn,

wastes generated in the school are returned to the outer environment to be disposed of.

Part 3. *People and the Social Structure of the School*

The people in the school form a community which functions as a social entity with its own internal organizations, government, interactions, niches, and decisionmaking capacities.

The school community can decide how to consume energy and other resources. They can develop for themselves a clean and aesthetically pleasing environment and a cooperatively functioning social organization;

and, in turn,

the school affects the larger community by its decisions, its programs, its attitudes, and its carrying capacity.

Heritage

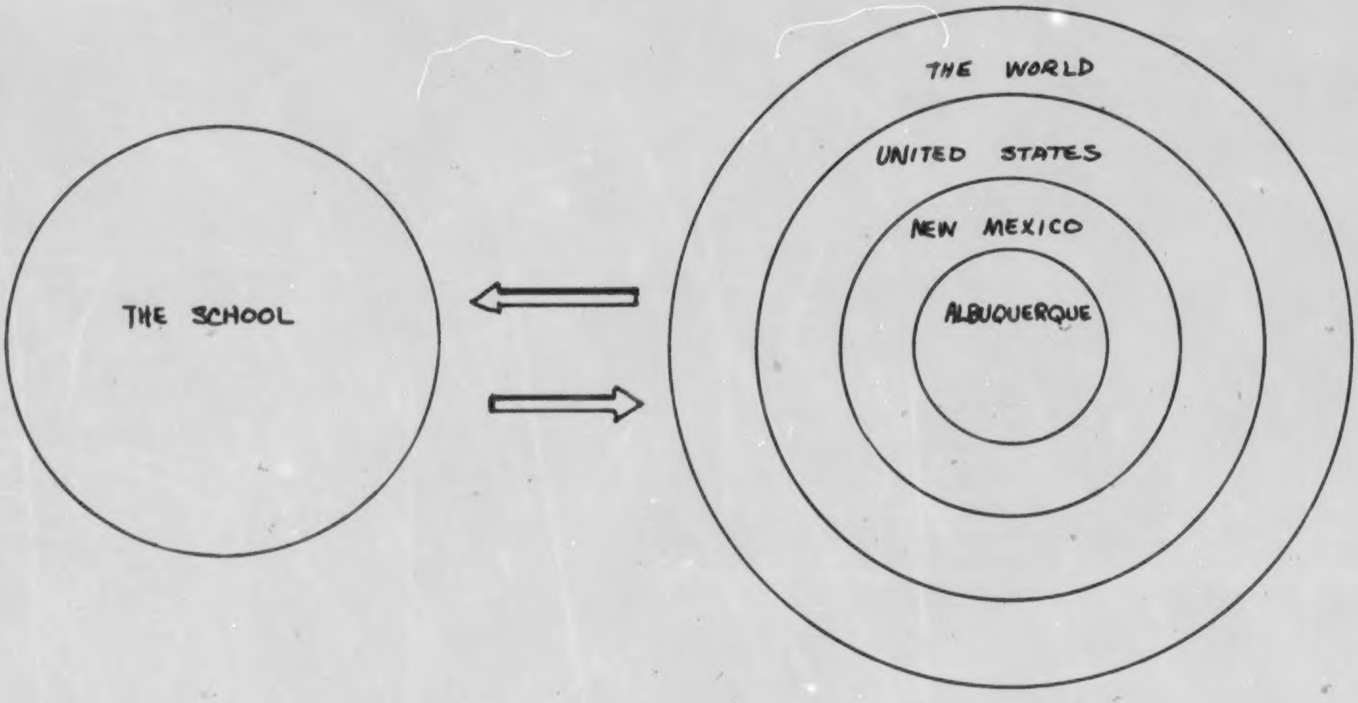
- What human succession has taken place in the school and neighborhood?
- What did the area look like before the school was built?
- What was the natural history of the area?
- How was this land used by those who lived here before us?
- What happenings in the past contributed to the school's appearance and functioning?

Here and Now

- How does the community use the school building and grounds?
- What demands does the school place on the community for transportation, parking facilities, and energy?
- How do the people in the school community affect those who live or work in the surrounding community?

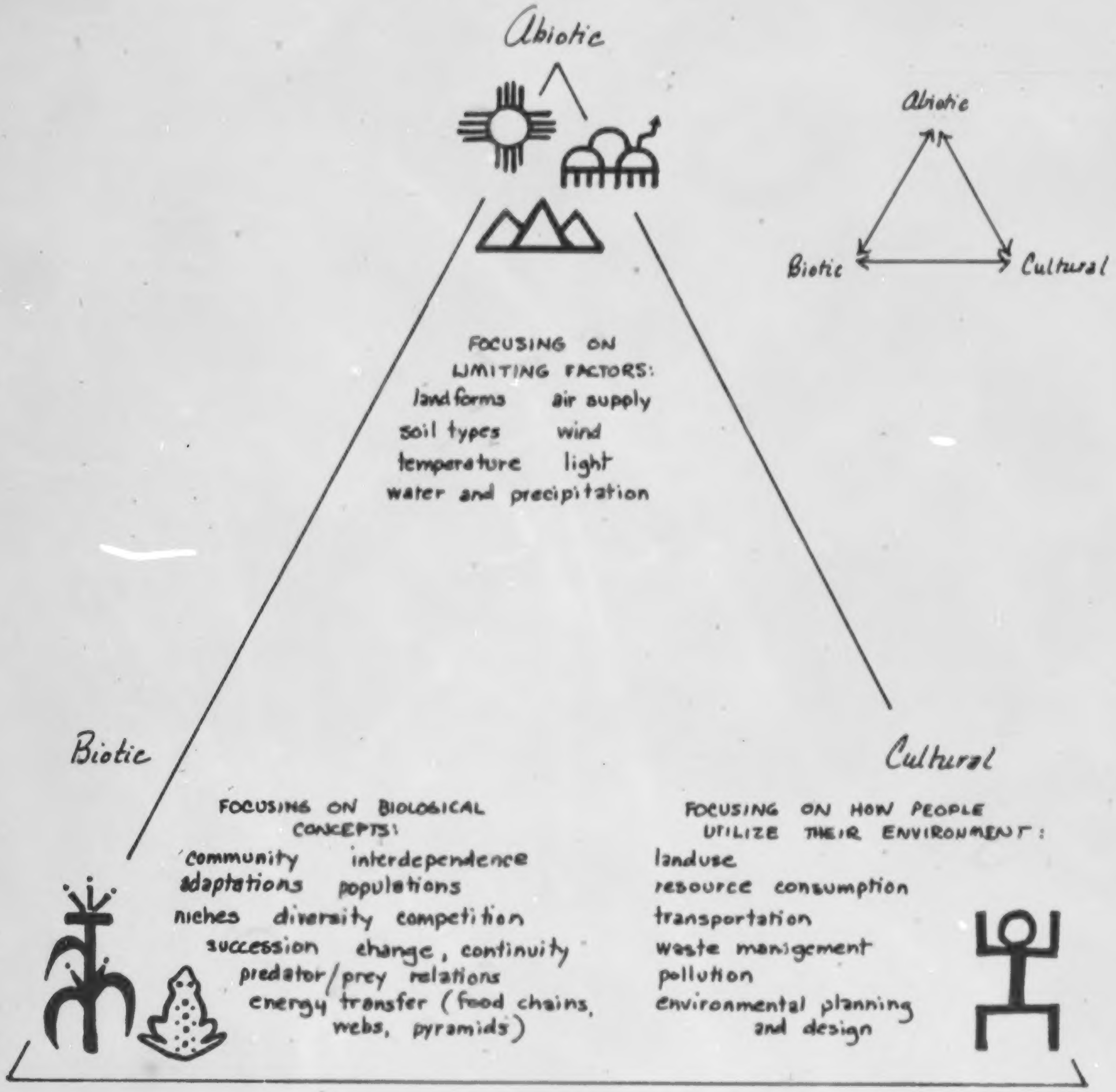
Horizon

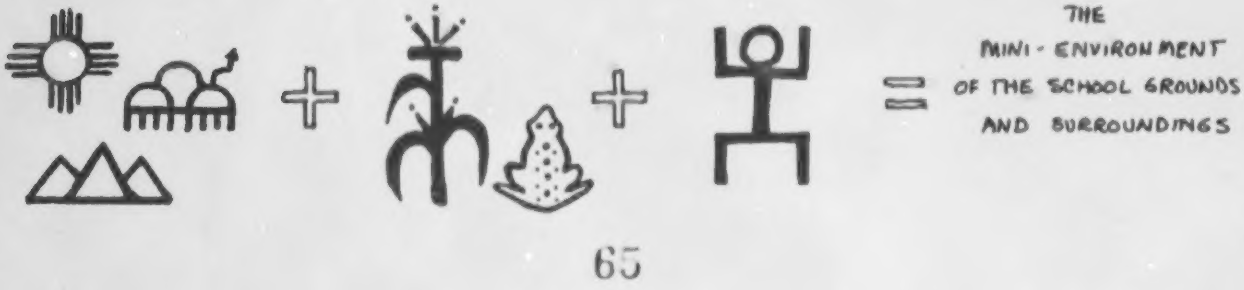
- What values and attitudes do students develop concerning their environment and their role in it?
- What experiences have students had with making reasoned and responsible decisions?
- What role can the school play in preserving and improving its environment?
- How can the school and its grounds be used more effectively by the school and by the larger community?

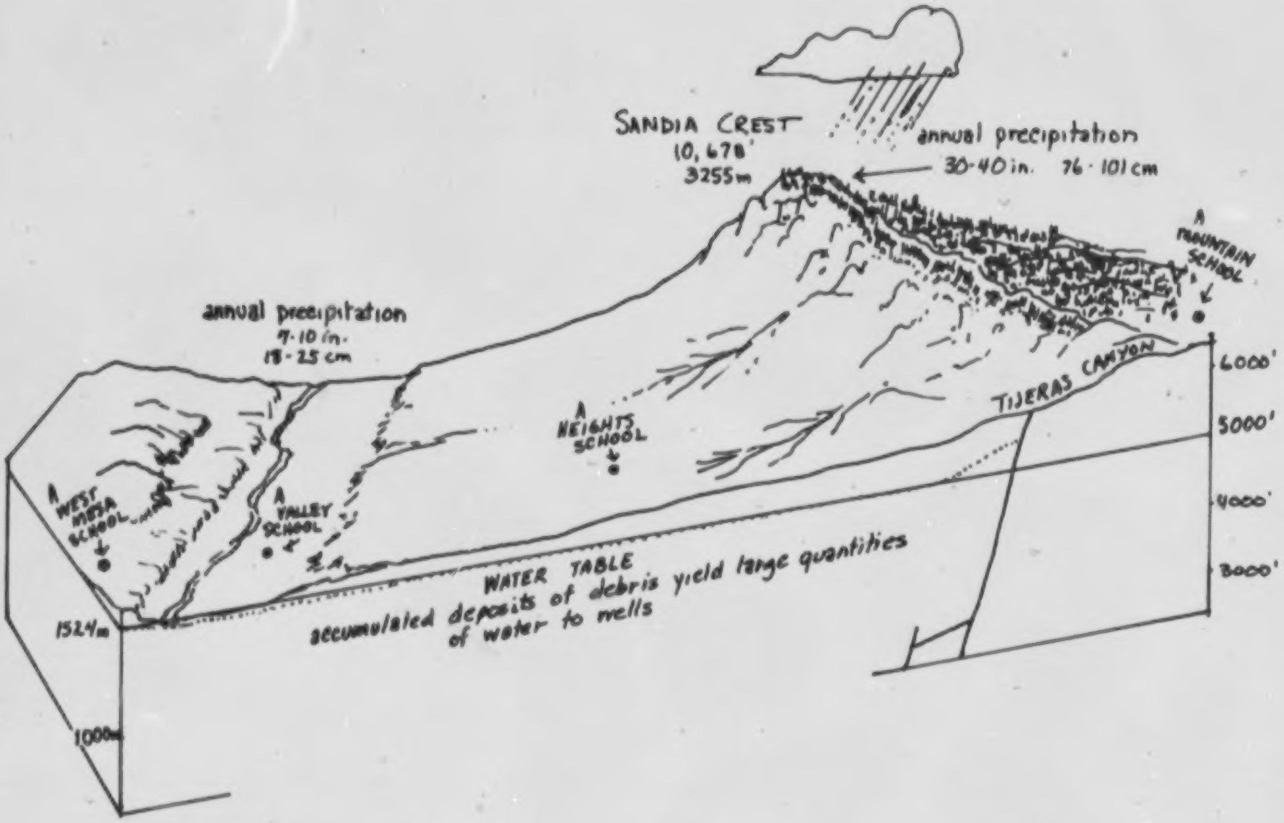


PART 1: THE SCHOOL GROUNDS AND SURROUNDINGS

A Total Environmental Triangle


Abiotic
Abiotic
Biotic
Cultural
FOCUSING ON LIMITING FACTORS:
landforms
air supply
soil types
wind
temperature
light
water and precipitation
Biotic
FOCUSING ON BIOLOGICAL CONCEPTS:
community
interdependence
adaptations
populations
niches
diversity
competition
succession
change, continuity
predator/prey relations
energy transfer (food chains, webs, pyramids)
Cultural
FOCUSING ON HOW PEOPLE UTILIZE THEIR ENVIRONMENT:
landuse
resource consumption
transportation
waste manigement
pollution
environmental planning and design


THE MINI-ENVIRONMENT OF THE SCHOOL GROUNDS AND SURROUNDINGS


SANDIA CREST
10,678'
3255m
annual precipitation
30-40 in. 76-101 cm
A MOUNTAIN SCHOOL
annual precipitation
7-10 in.
18-25 cm
A HEIGHTS SCHOOL
A WEST MESA SCHOOL
A VALLEY SCHOOL
TIJERAS CANYON
6000'
5000'
4000'
3000'
WATER TABLE
accumulated deposits of debris yield large quantities of water to wells
1524m
1000m

Albuquerque schools have varying abiotic conditions:

- landforms—mesa, valley, mountain
- altitude range—5,000′–7,000′ (1524 m–2134 m)
- annual precipitation—7″–20″ (18 cm–51 cm)
- temperature at a given time can be—
  –10°F (6°C) colder in the Valley than in the Heights on cold, clear mornings and evenings
  –10°F (4.8°C per kilometer) colder in Tijeras Canyon than on West Mesa; a drop of 5.4°F for every 1,000′ change in elevation

Consider how mountains influence the water cycle . . . how air inversions affect temperature, and . . . how altitude affects temperature.

Abiotic/Biotic Profiles

While Section I dealt with the natural environment of the entire area surrounding and including Albuquerque, the profiles in this part of Section III offer a closer look at the physical characteristics of four specific locations in the area which support school communities.

A WEST MESA SCHOOL

The West Mesa, shaped primarily by water, wind, and volcanic activity, lies to the west of the Rio Grande inner valley within the Rio Grande rift. At one time, this area was actually part of the Rio Grande floodplain. The river meandered over a broad section depositing silt and gravel, and cut terraces, some of which can still be seen on the Mesa. Much of the surface layer consists of fine, wind-blown sand which is reworked periodically.

Clearing or overgrazing the soil frequently resulted in a hard pan, or caliche layer, formed and exposed by wind erosion. Thick sodgrasses which formerly held down the soil were often replaced by disturbance-associated grasses frequently found around the school yard (fluffgrass, sand dropseed, and threeawn), as well as by such wildflowers as locoweed, snakeweed, purple aster, and the poisonous purple nightshade. Introduced species such as tumbleweed are now the dominant plants in many areas of soil disturbance. With less than 10 inches (25 cm) average annual precipitation, Mesa plants and animals must be adapted to dry environments. Plant adaptations include small leaves, spines, and hairs surrounding breathing pores.

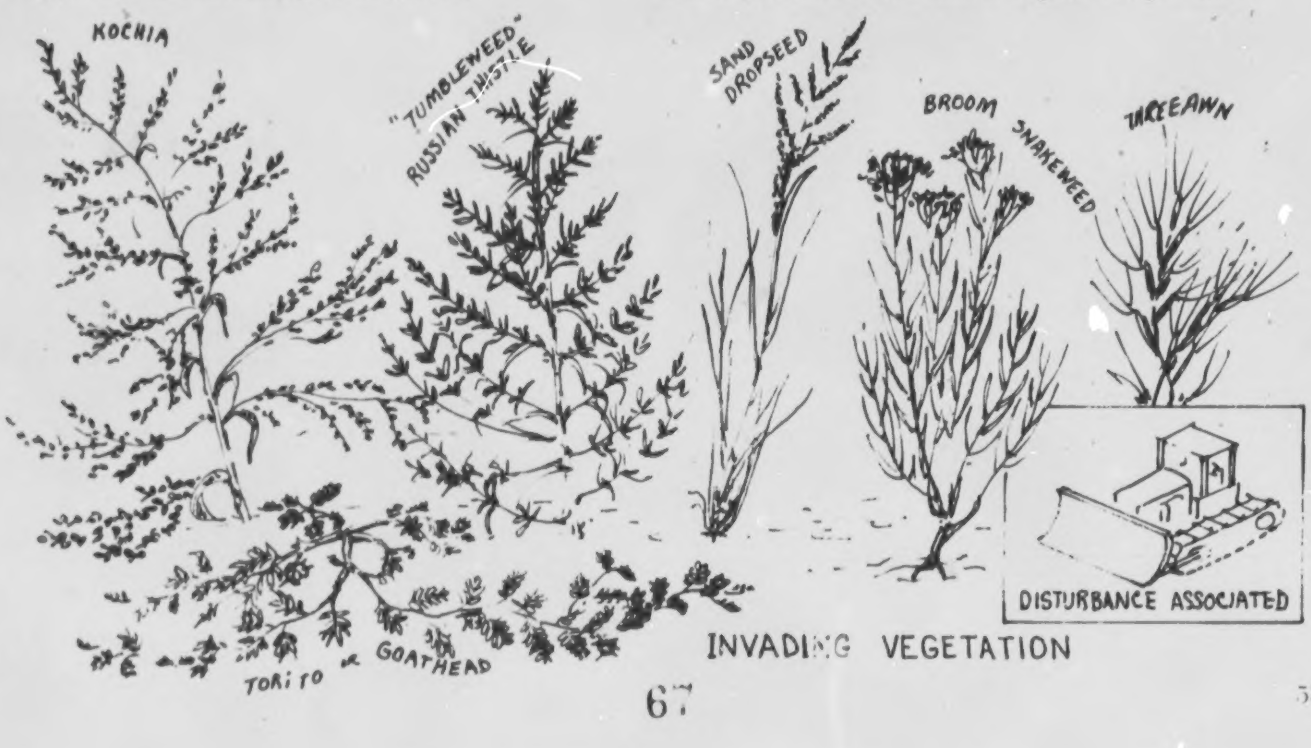
Nocturnal animals (kangaroo rats, pocket mice, whitefooted mice and wood rats), most of whom burrow in the ground to escape the heat and drying, are very common. Lizards, horned lizards, several varieties of harmless snakes, and even the spadefoot toad are also frequently found on the West Mesa. The birds to be looked for around the school yard are English sparrows, starlings, and pigeons.

There is evidence that the Mesa is changing from a shortgrass prairie to a desert grassland. Scattered remnants of pinons, juniper, and yucca are indicative of a wetter time. Overgrazing has undoubtedly hastened this change, and a lowered water table may also have had an effect.

A VALLEY SCHOOL

The Valley schools are in the floodplain of the Rio Grande. Before 1930, most of this land was in various stages of riparian, woodland, and aquatic natural communities. Levees, a system of drain canals, and the North and South Diversion Channels have reduced the threat of flood from the river and arroyos.

Increasing urbanization of the area has reduced the number of farms and the amount of irrigated acreage. Farms



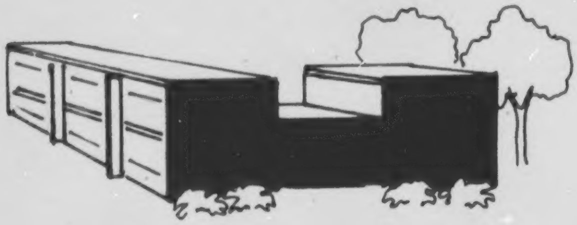
INVADING VEGETATION

which remain are used to grow alfalfa and to pasture dairy cattle.

Most of the area is disturbed, and vegetation growing in vacant lots and fields consists primarily of herbs and grasses. A number of common weeds such as pigweed, lamb's quarters, milkweed, cocklebur, and goathead are found. Grasses such as sand dropseed and alkali sacaton are also common. Elms grow in readily disturbed areas, and salt cedar and willow can be found along irrigation and drain canals.

Disturbance of the Valley area has significantly reduced the presence and diversity of wildlife. Those species which are found are adapted to agricultural and urban land use. Migrating birds occasionally pass through the urban area and can be seen in the trees. Some spillover from adjacent riparian woodland animals also occurs. Urban areas are dominated by typical, civilization-adapted birds such as house sparrows, starlings, house finches, and pigeons. A large flock of crows winters in the valley, roosting in riparian woodlands and feeding in irrigated fields and urban sections. Robins and grackles are also common. Many of these birds, as well as house mice, Norway rats, and pocket gophers (the dominant mammals), are considered pests when their populations become large. Woodhouse's toads are still common, and garter snakes are occasionally found. Mosquitos, which breed in the stagnant and sometimes flowing water, occasionally are vectors for encephalitis.

A HEIGHTS SCHOOL



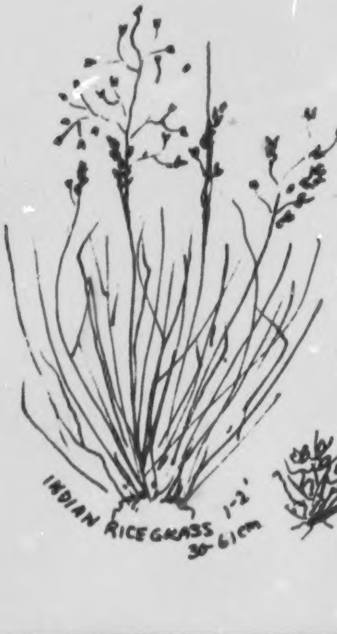
The area known as the East Heights was formed by debris washing off the Sandia Mountains onto more level ground. These sloping outwash plains are called alluvial fans because, when viewed from above, they tend to be fan-shaped. The apex, or converging points, of these fans are the mouths of large arroyos and canyons of the Sandias. (See illustration in Section I, page 9.)

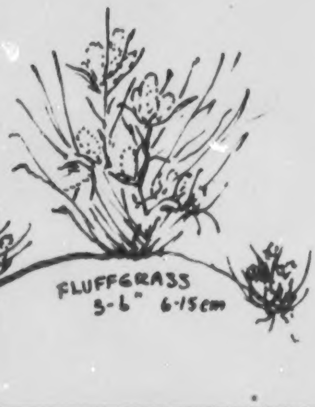
When the runoff from these steep canyons hits the more level ground of the Plains, much gravel, sand, and silt is dropped. The streams then form a delta-like series of arroyos which meander and redistribute themselves all over the fan, depositing more rock material. Arroyos sometimes carry savage floodwaters which can destroy homes and buildings in their path. The soils deposited here vary from coarse to fine silt, and are not uniform. Generally, they tend to be coarse near the mountains and in the arroyos.

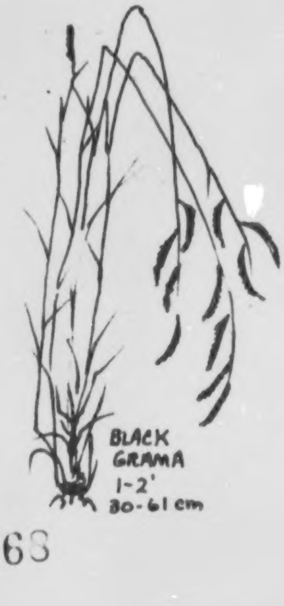
Precipitation is between 8 and 14 inches (20-35 cm) a year. Generally, there is greater precipitation at high elevations and more snowfall in those parts. The Heights does not experience the temperature extremes of the Valley.

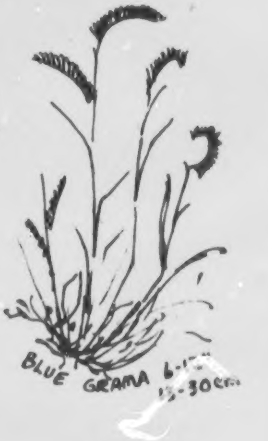
The natural vegetation of the Heights is shortgrass. Prairie grass is approximately 35 percent (by weight) of the total vegetation. About 15 percent of the ground is covered by vegetation. Important grasses are black grama, sand dropseed, galleta, threeawn, blue grama, alkali sacaton, and fluffgrass. Shrubs and wildflowers such as broom snakeweed (a sign of disturbance), blazing star, prickly pear, purple nightshade, aster, winterfat, and mallow are also found. More woody plants are found in arroyos. Among these plants are apache plume, skunk bush, and fourwing saltbush. When this plant community is disturbed, there will be an increase in tumbleweed (Russian thistle), broom snakeweed, sand dropseed, fluffgrass, and prickly pear. Much of the Heights is developed and in many areas, only the arroyos are left in a semi-natural state. A nearby vacant lot, however, may have some of these species.

Animal life consists mainly of small mammals, birds, reptiles, and insects. The most common animals are gophers, mice, kangaroo rats, ground squirrels, horned larks, sparrows, sparrow and cooper hawks, lizards, horned lizards, snakes, grasshoppers, praying mantises, carrion beetles, ants, and spiders.

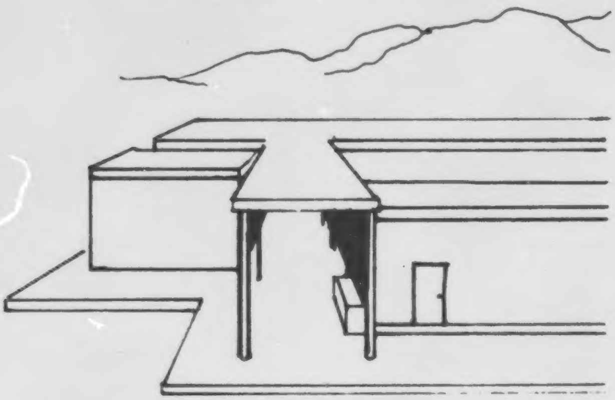








A MOUNTAIN SCHOOL

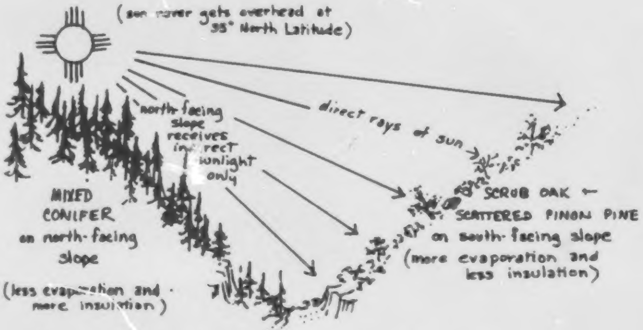


The two mountain schools and the APS Outdoor Education Center are the only schools in the Albuquerque system located *outside* of the Rio Grande rift. They are situated on the easterly-dipped slope of the Sandia-Manzano uplift, a fault block which defines the easterly edge of the rift zone. The schools are located in pinon-juniper woodland. Taller, denser vegetation, seen uphill from the school grounds, attests to the greater rainfall received in the higher elevations of the mountains. The drainage canyons also have taller, greener, more lush growth due to greater total moisture (precipitation plus runoff).

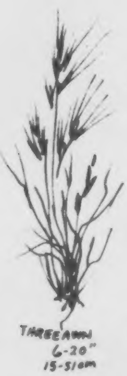
It is common in the Sandias to see differing vegetation on the two sides of a canyon: tall firs, ponderosa, and spruce on northern-facing slopes, shorter pinons, junipers, scrub oak, and cactus on the hotter, drier, and environmentally more fragile southern exposure of the same canyon. Two children in the same class, living only a very short distance from each other, might observe very different habitats outside their homes.

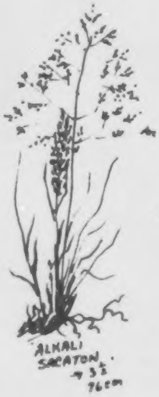
Roosevelt A. Montoya School in Tijeras and San Antonito in Sandia Park are both located in areas which are local depositories of mud and gravel recently eroded from surrounding uplands. (On a geological map each location is labelled as "Q-a," or Quaternary [recent] alluvial material.) In eroding bedrock layers not far from mountain school playgrounds, direct evidence can be found that ancient environments here were vastly different from today's. Roosevelt A. Montoya is located close to a very thick, fossiliferous layer of limestone precipitated out of an ancient sea inhabited by brachiopods, crinoids, bryozoans, and corals some 300 million years ago. (Ideal Cement Company quarries this limestone for its industrial purposes.) Seams of coal near Tijeras were formed millions of years ago from vegetation in a steaming swamp environment. Within the red Abo formation of Tijeras and Sandia Park may be found reptile tracks and plant fossils from a humid, warm, non-marine environment which deposited iron-rich muds and sands on a vast river floodplain. Looking at the cross-bedding within some sandstone deposits, geologists tell us of dunes of clean sand swept over large areas by strong, persistent Sandia winds. A gypsum quarry three miles south of San Antonito on the east side of Route 14 makes us aware that that particular area was once a salty lake which evaporated and precipitated layers of gypsum salts. It is difficult for us today to imagine these New Mexico environments so vastly different from the one that man, so recently on the scene, has experienced. But, the evidence is here — in the rocks! At schools located within the Rio Grande rift (the other 98 percent of Albuquerque's schools) it would be necessary to drill from 2 to 4 miles (3 to 6 km) into the earth to find the same bedrock evidence of the geological history of the Albuquerque area. Children in the mountain schools need only look around them.

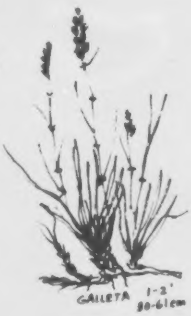
EXPOSURE AFFECTS LIFEZONES:


(sun never gets overhead at 35° North Latitude)
north-facing slope receives indirect sunlight only
direct rays of sun
MIXED CONIFER on north-facing slope
(less evaporation and more insulation)
SCRUB OAK ← SCATTERED PINON PINE on south-facing slope
(more evaporation and less insulation)

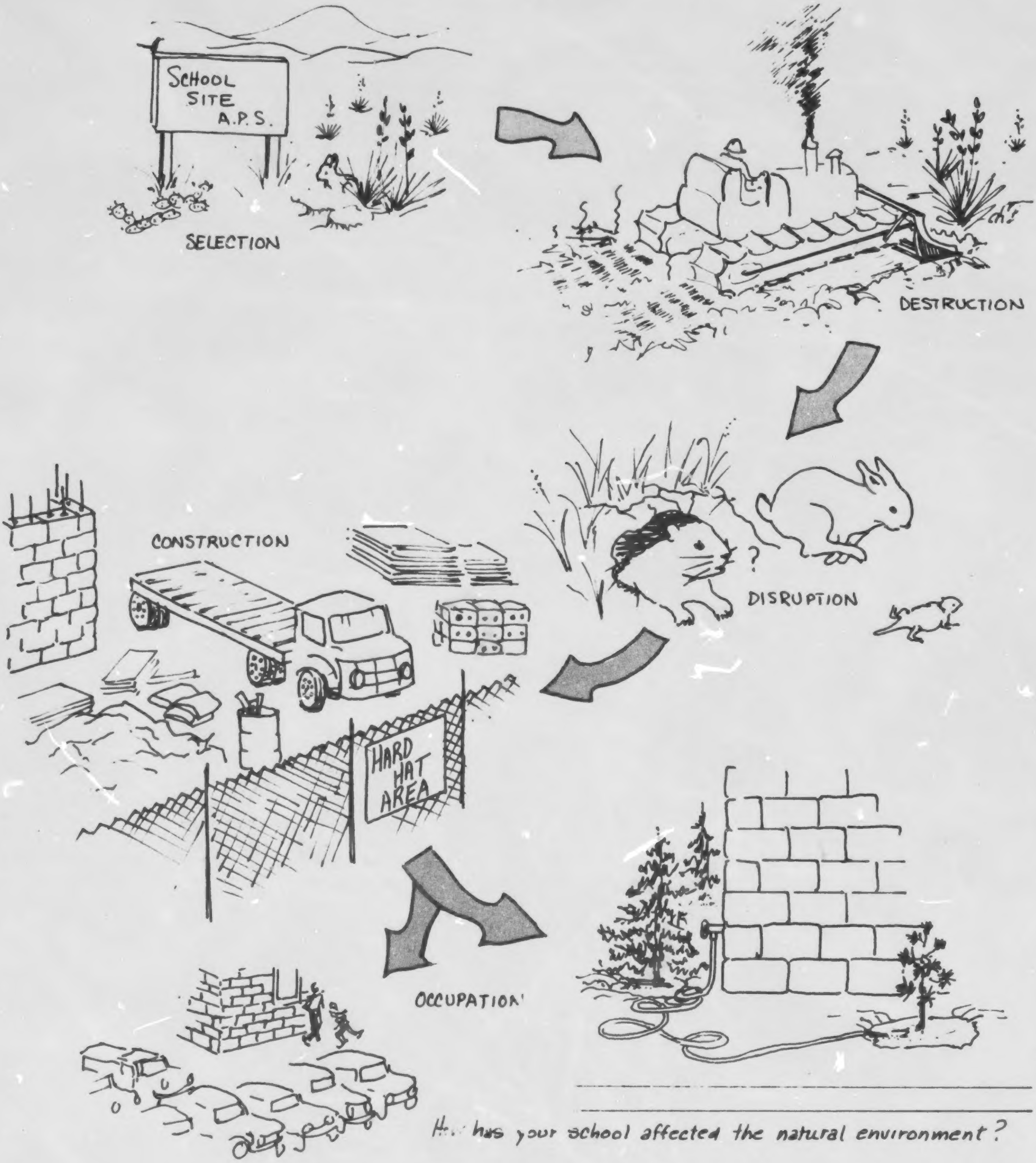
TWO MICROCLIMATES IN A MOUNTAIN CANYON


THREEAWN
6-20"
15-51cm


ALKALI
SACATON
~ 3'
76cm


GALLETA 1-2'
30-61cm

AN ABIOTIC/BIOTIC/CULTURAL PROFILE


SCHOOL SITE A.P.S.
SELECTION
DESTRUCTION
DISRUPTION
CONSTRUCTION
HARD HAT AREA
OCCUPATION

How has your school affected the natural environment?

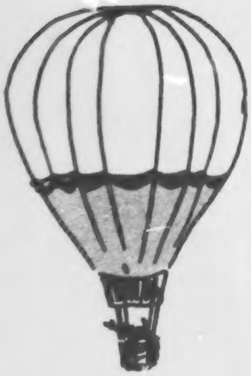
SUGGESTED INFUSABLE AREAS OF THE CURRICULUM

Grade	*Subject Area*	*Topic*	*Activities*
K	Social Studies	*Small Group Living:* playground; district	2–4
1	Social Studies	*Small Group Living:* playground; district	
	Science	*Organisms:* seeds and plants; food webs	2, 3, 8–13, 22
2	Social Studies	*Community Living:* geography of Albuquerque—school and playground	1, 16, 19
	Science	*Life Cycles:* germinating seeds; animal life cycles; genetic identity; What is alive?	3, 11, 22
3	Social Studies	*Rural and Urban Living:* comparative study of cultures; conservation; geography; map skills	1, 2, 4, 5, 7, 18, 21
	Science	*Populations*	22
4	Social Studies	*An Expanding World:* Southwest region—general knowledge of landforms	1
	Science	*Environments:* environmental factors; change outside; organisms in the area; animal responses to environmental factors; optimum range	3, 8–12, 14, 15, 19, 20, 21
5	Social Studies	*In the Americas:* geography of New Mexico and Southwest—location and uses of specific landforms; control of natural resources; specific population centers	1, 16
	Science	*Communities* *Outdoor Education Center* program	3, 8–17, 19, 20, 22
6	Social Studies	*Roots:* "What are the physical characteristics of New Mexico?"; "How have the people of New Mexico utilized their environment?"; introduction of public education	1–7, 18, 21, 23
	Science	*Ecosystems:* concept of ecosystems; water cycle; carbon dioxide/oxygen cycle	1, 8, 13, 17
		Middle School Science Curriculum I. 2. d. What Does Light Do to Living Plants? III. 1. a. Your Environment 1. b. Environmental Factors in an Ecosystem 1. c. It's Not the Heat, It's the Humidity 1. e. Oh, Give Me a Home 1. f. What's in the Zoo? 1. j. Temperature As an Environmental Factor 1. k. Light—An Environmental Factor on Seeds 1. m. Raindrops Keep Falling on My Head 1. n. Dead is Dead 5. a. Population Boom 5. b. What is Biodegradable? 5. c. Man's House 7. a. Air Quality 7. b. Sick Air 7. e. Garbage 7. h. Thermal Inversion 9. a. Food Chain 9. d. Decomposers in Food Chains 11. a. Pests	1, 2, 4, 6, 8, 11, 13, 14, 16, 17, 19, 20

		IV. 1. d. An Icy Problem 2. a. Erosion Composition 2. c. Soil Layers 2. d. Erosion of Rocks from Water Action 2. g. Ability to Hold Water 2. h. Soil Properties 3. a. Moisture in the Atmosphere 3. b. Rain, a Form of Precipitation	
7	Social Studies	*History of Geography:* relative locations	1
HS	Social Studies	*Geography:* study of the earth and the interaction of people with the earth	1, 2
	Science	(*Biology I*) Ecology: populations; ecosystems; man's role	8–15, 17, 19, 20
		Environmental Science: air pollution; food chains; food webs, communities	6, 8, 13, 19
		Flora of the Southwest: general flora of the Albuquerque–Sandia Mountains region	2, 3, 11, 14, 22
		Terrestrial Ecology: ecological concepts of population	

RESOURCES

Mines Publications, Inc. *Mapping Small Places.* Minneapolis, MN: 1971.
Mines Publications, Inc. *Miniclimates.* Minneapolis, MN: 1971.
National Audobon Society. *A Place to Live.* New York: 1972.
NEED (National Environmental Education Department). *Adventure in Environment.* Morristown, NJ: Silver Burdett Co., 1972.
Russell, Helen R. *Ten-Minute Field Trips.* Chicago: J. G. Ferguson Publishing Co., 1973.

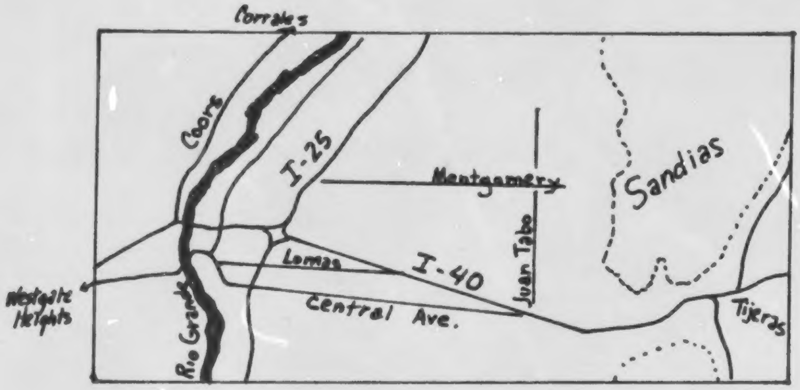


> "What children learn through manipulation of the environment is nothing less the ability to think."
>
> David Elkin

EYE-OPENER WORKSHEET 3: WHAT CAN YOU SEE AROUND YOUR SCHOOL?

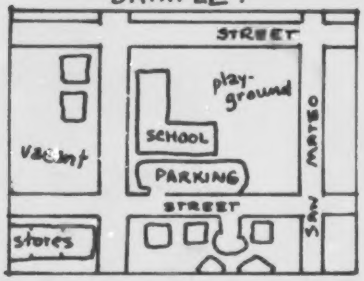
- In what part of the city is your school located? ____ Southeast ____ Southwest ____ Northeast ____ Northwest ____ Outside the city

- Locate your school by placing an "X" on the map below.


Corrales
Coors
I-25
Montgomery
Sandias
Lomas
I-40
Juan Tabo
Westgate Heights
Rio Grande
Central Ave.
Tijeras

- In the box below, draw a map showing your school, the streets closest to it, and the kinds of buildings near the school (houses, stores, offices, etc.). On a separate paper, draw this map to scale.

SAMPLE:


STREET
play-ground
SCHOOL
vacant
PARKING
STREET
SAN MATEO
stores

YOUR SCHOOL:

- Check all of the following features your school has: Discuss with your classmates changes you would make and why.

____ ball field
____ basketball courts
____ playing field (dirt)
____ playing field (concrete)
____ playground (swings, slide, etc.)
____ grassy lawn

____ garden (check the kind)
  ____ vegetable ____ Southwestern
  ____ non-native
____ trees
____ parking lot for teachers
____ parking lot for students

- Find the areas of the playing fields and the grassy lawn. Find area per student of each. Use metrics.

Feature	*Area*	*Area/Student*
ball field		
playing field (dirt)		
playing field (concrete)		
grassy lawn		

- How much rain does your school yard get? Keep a record for one month on the chart below: (Use a rain gauge to measure the rain. Use metrics.)

Date	*Amount of Rain*	*Date*	*Amount of Rain*

- If your school grounds are not clean, what do you think could be done to make them better? What changes could you and your classmates make to improve your school ground? Could other classes help? How? Could parents? How?

"TUNA"
OR "PRICKLY PEAR" CACTUS

ACTIVITIES

Eye-Opener Activities: 3

1. After a heavy rain, walk outside the school and observe what happened.
    - Were there flash floods? Are there gullies? Puddles? What happened to the water on the pavement? On the grass? On bare soil? Is there runoff to the street? Where does that water go? How does all of this relate to the water cycle?
    - Write an illustrated story pretending you are a drop of rain water. What choices would you have when you fell to the earth?
    - Did the rainstorm create an erosion pattern on the soil, or change an existing one? How?
    - How does the amount of water that fell in your part of the city compare with the amount received elsewhere? Explain.
    - How would a 10 inch (25 cm) change in annual rainfall affect your area? Explain.
2. Take a walk around the school and note landscaped areas.
    - Is the landscaping "Southwestern?" If not, do some of the plants require special care?
    - How often are the grounds watered? Is there a sprinkler system? How much water is used during the growing season? (Check with custodian.) How much water is this per square meter of the school grounds?
    - How are the grounds fertilized? Are pesticides used? If so, what kinds? What are the pros and cons of pesticides? What are the advantages and disadvantages of Southwestern-type gardens? Of gardens with non-native plants?
    - Interview some homeowners near the school who have distinctive gardens. Why did they select that particular landscaping?
3. Walk to a vacant lot or an unlandscaped area around the school.
    - How does this area compare with the landscaped part of the school grounds?
    - How do human "trample" patterns affect your school environment?
    - What examples of plant succession can be seen?
    - Have the students ever noticed the city's weed control program in operation? What is the purpose of this program?
    - If this area is on the school grounds, would it be suitable for a wildflower garden? Why? How might one be started?
4. Develop a map of your school grounds to determine where litter is found. Use different symbols for each type of litter.
    - What kinds of litter predominate? Where is most of the litter found?
    - Where are the litter receptacles? How often are they emptied?
    - Is most of the littering done by students or by other people who use the school grounds?
    - What attempts have been made to conduct a "consciousness-raising" anti-litter campaign? Could your class do it? Does your school participate in Albuquerque's "Clean Cities Campaign?"
5. Conduct research to find out why this site was selected for the school.
    - Was the site selected because it was readily available? Because it was considered suitable? What makes a site suitable for a school? Was there a heavy population concentration in the area when the site was selected?
    - How do you think the school site might have looked before construction began 100 years ago? 500 years ago?
    - Write a brief paper on how your school has affected the natural environment.
6. Discuss the problem of transportation for high school students.
    - How many students drive to school? Why do they drive? Do they carpool?
    - How much space around the school is utilized as parking lots?
    - What alternative methods of transportation do the students have?
    - Construct a piegraph to show what percentage of students use each method of transportation. Include: school bus; public bus; carpool; self-driven auto; bicycle; walking. Does the percentage distribution of modes of transportation used vary much by senior high grade level? Explain how much and why.
    - What effects do extensive use of the automobile have on Albuquerque's environment?

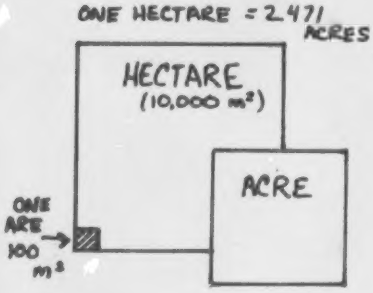
EYE-OPENER WORKSHEET 4: A NEW LOOK AT A VACANT LOT

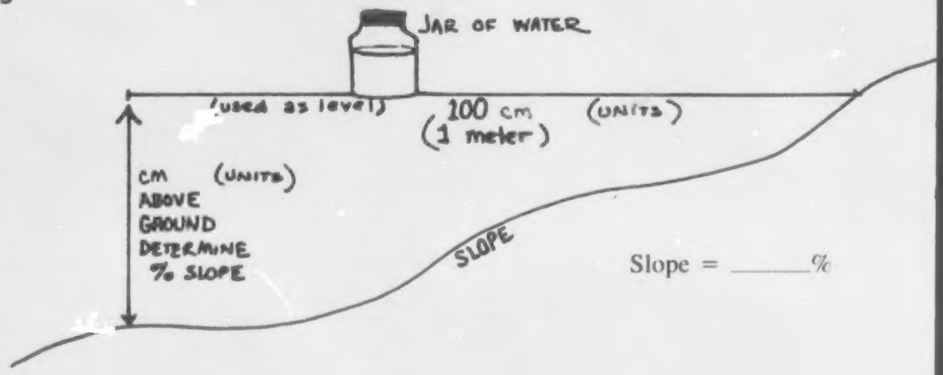
Start this trip in your classroom. Discuss a vacant lot near your school and try to reach agreement about the points listed below. Record your decisions.

- Is the lot regular or irregular in shape? ______________________
- Approximately how big is the lot? The size of an average city lot? ____ Half a hectare? ____ One hectare? ____ Other size? ____
- Is the lot sloped? ____ Flat? ____ Partly sloped and partly flat? ____
- Are there any trees on the lot? ____ If so, how many? One? ____ Two? ____ Between two and five? ____ More than five? ____ . What kinds of trees are they? ______________________
- How much of the ground is bare soil? Less than 50%? ____ Between 50 and 75%? ____ Between 75 and 100%? ____ 100%? ____
- Do any animals live in the vacant lot? ____ If so, what kinds? ______________________
  ____
- In what ways have people affected the vacant lot? Litter? ____ Compacted soil at short cuts? ____ Indirect ways such as gully formation caused by water runoff from nearby paved surfaces? ____ Other ways? ____
  ____

Take a trip to the vacant lot to see how close your recollections were to the facts.

- How is the lot shaped? On a separate piece of paper, draw a scale map of the lot. Use a compass to help orient the map properly.
- Measure the perimeter of the vacant lot in meters. ______________________
- Calculate the area in hectares. ______________________
- Is the lot sloped, flat, or both sloped and flat? ______________________
- If it is partially sloped, calculate the percentage of slope by using a measuring stick, another stick, and a baby food jar half-filled with water. (See diagram.)





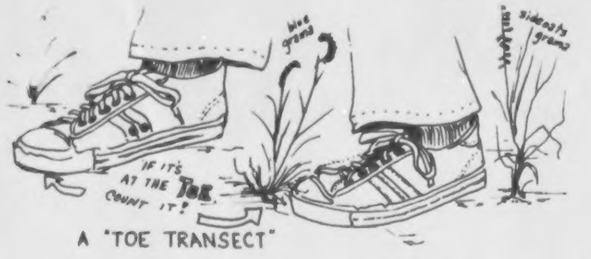
Slope = ____%

Illustration adapted from Forest Service Teaching Materials for Environmental Education—July, 1973, p. 12.

- How many trees are in the vacant lot? ____ If you know their names, list them below. If you don't, describe them.

Name or Description	*Number*

Divide into groups of three. After each group selects a section of the vacant lot to study, do a 100-step "Toe Transect" (see below) to determine what percentage of the surface is covered by litter, annual grass, perennial grass, forb, shrub, rock, and bare soil. (Use table below.)



Definitions:

litter—plant debris on ground surface
annual grass—lives for a single year and depends on seeds for reproduction
perennial grass—lasts from year to year from the same root base
forb—wildflowers and "weeds"
shrub—persistent woody plant smaller than a tree

*"Toe Transect" Survey**

Working in groups of 4, stretch a 100 foot tape along the ground where you want to inventory the types of plants of your area. This is called a 100 foot transect. Record what you find at every foot along the tape or transect on the table below. Record presence of the item below by putting a check (✓) if present. Leave blank if not present.

Sample Every Foot	Rock	Bare Soil	Litter	Annual Grass	Perennial Grass	Forb	Shrub	Sample Every Foot	Rock	Bare Soil	Litter	Annual Grass	Perennial Grass	Forb	Shrub	Sample Every Foot	Rock	Bare Soil	Litter	Annual Grass	Perennial Grass	Forb	Shrub	Sample Every Foot	Rock	Bare Soil	Litter	Annual Grass	Perennial Grass	Forb	Shrub
1								26								51								76							
2								27								52								77							
3								28								53								78							
4								29								54								79							
5								30								55								80							
6								31								56								81							
7								32								57								82							
8								33								58								83							
9								34								59								84							
10								35								60								85							
11								36								61								86							
12								37								62								87							
13								38								63								88							
14								39								64								89							
15								40								65								90							
16								41								66								91							
17								42								67								92							
18								43								68								93							
19								44								69								94							
20								45								70								95							
21								46								71								96							
22								47								72								97							
23								48								73								98							
24								49								74								99							
25								50								75								100							

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*Reprinted from: *Pocketbook for Environmental Awareness: People & Natural Resources*. Youth Conservation Corps. Washington: Forest Service United States Department of Agriculture.

Answer the following questions based upon the information recorded in the "Toe Transect" survey.

- Which items had the greatest percentage of coverage? ____________________
  Which had the least? ____________________
- Did certain plants tend to be associated with certain types of areas such as bare places, rocks, shrubs, etc.? ____ If so, which? ____________________
  ____________________ how might this be explained?
  ____
- Which of these areas might make the best habitat for animal life? ____________________
  ____________________ Why? ____________________
- What kinds of human litter did you find? ____________________
- Where was most of it? ____________________

Use hoops made from wire coathangers or hula hoops to do an animal survey. Each group should randomly toss its hoop five times. Examining the area circumscribed by the hoop each time, record your findings below. Compile the findings of all groups.

Animals seen	*Animal signs seen*	*Number of signs per toss*					*Total for 5 tosses*
		1	*2*	*3*	*4*	*5*	
ant		8	0	2	10	0	20
beetle		1	2	0	0	1	4
	dog's pawprint	0	1	0	1	1	3

- Did you find animal life in the places you expected to? ____ If not, explain. ____________________
  ____
- What other signs of animals did you see which did not appear in the hoop sample? ____________________
  ____
- Which animals were most prevalent? ____________ Least? ____________
  Can you explain why? ____________________

Worksheet Summary

- In what ways have people affected the vacant lot? ____________________
  ____
- How well did your recollection of the vacant lot compare with your findings? ____________________
  ____
- Name one thing in the lot, or about the lot, that you like the most. ____________________
  ____
  Why do you like it? ____________________
- Name one thing in the lot, or about the lot, that you like the least. ____________________
  ____
  Why do you dislike it? ____________________

7. Map your route to school from memory, then from observation. Compare the two.
    - What was remembered most easily? Why? What was left out? Why?
8. Using string circles, "capture" an environment. Repeat in a variety of areas (lawn, eroded soil, vacant lot, etc.)
    - What communities do you see? Whose shelters and food supplies are included? What organisms are the food producers? The primary consumers? The secondary consumers? The decomposers? Which organisms are more numerous, primary or secondary consumers? Why?
    - How many circles might it take to support an insect? A bird? A rodent? A large herbivore? A large predator?
    - What role does the sun play in the energy transfers in these food webs?
    - How many life support systems can you see functioning? (Food production, storage, waste disposal, water, etc.). If you were to try to diagram these systems, would it be better to use a vertical flow chart or a web of interrelated cycles? Why?
9. Select an environment outside, imagining yourself to be variously the size of a lizard, an ant, and a dog. Working in small groups, try to figure out how you might survive in that environment.
    - What kinds of shelters might you have? Tools? Clothing? Food? Modes of transportation?
10. "Invent" adaptation by designing a creature to replace an actual animal (insect, bird, reptile, mammal) you might find on the grounds near your school or a nearby vacant lot. Keep in mind food supply, shelter, enemies, mobility. Draw, paint, or fashion in clay or wire sculpture the animal you invented.
    - How does this creature compare with the one it was to replace?
    - Can you design a predator to eat the creature you made?
11. "Invent" adaptation by designing a plant to replace an actual plant found in a vacant lot. Include seed and seed dispersal; water needs; flower; protective devices.
    - What niche (or role) might this plant fill?
    - Would the seed travel by air, water, in birds, or in animal fur?
12. "Invent" prey-predator relations by designing a predator capable of: digging up roots; catching flying insects; picking up an egg; picking up leaves; eating meat; getting animals from under ground.
    - What kinds of animals might be able to escape from one of the predators you designed?
    - What are some of the defenses they would need to protect them from their predators?
13. Construct a vacant lot food chain using the domestic cat as top consumer.
    - How would the chain differ if the cat's prey was, in turn, a mouse, a butterfly, and a lizard?
    - How might this chain look if it was drawn as a pyramid of numbers?
14. Inventory the plants in a specified section of the schoolyard or vacant lot.
    - Which plants are dominant?
    - How are these plants especially well-adapted to the biotic and cultural conditions in the schoolyard?
15. Watch ants carrying food to their nests, or lift up a rock to see what the ants do when their nest is disturbed.
    - From what can be observed, why are ants called "social insects?"
    - What do ants carry into the nest? Do they carry anything out? If so, what? Why? What do they do with it?
    - What subsistence systems do ant colonies have?
16. Trade a bucket of playground dirt with a school from a different part of the city (Valley, Mesa, Mountains, Heights). Compare color, texture, porosity, and composition. (See illustration Activity 20.)
    - What differences do you notice? What accounts for these differences?
    - How can these differences explain such things as water retention, erosion and flooding, planting possibilities, and playground accidents?

17. Collect nature's discards (egg shells, feathers, fallen leaves, molted skins, grass clippings, etc.). If possible, obtain permission to set up a compost pile in an out-of-the-way place outside the classroom. Otherwise, make a mini-compost pile in a moist classroom terrarium.

    - What changes occur in the materials (appearances, temperature, texture, odor)?
    - What causes **decay**?
    - What are the best conditions to bring about decay?
    - How can this compost system be used to demonstrate nature's recycling process?

18. Have students go outside the school and make a map of a nearby nonresidential street containing a vacant lot. Have them select "roles" (realtor, small business owner, member of planning commissions, city councillor or county commissioner, young child, teenager, parent of young child, senior citizen, social worker, developer, teacher, etc.) and role-play to decide how this parcel of land should be used.

    - What are the present zoning regulations for the area? Can zoning be changed? How?
    - Who owns the land?
    - What are your neighborhoods's needs? How can you find out?
    - Are multiple uses possible? If so, which?
    - Who has the final say about how the land is to be used?
    - What kind of environmental impact would the different suggested uses have?

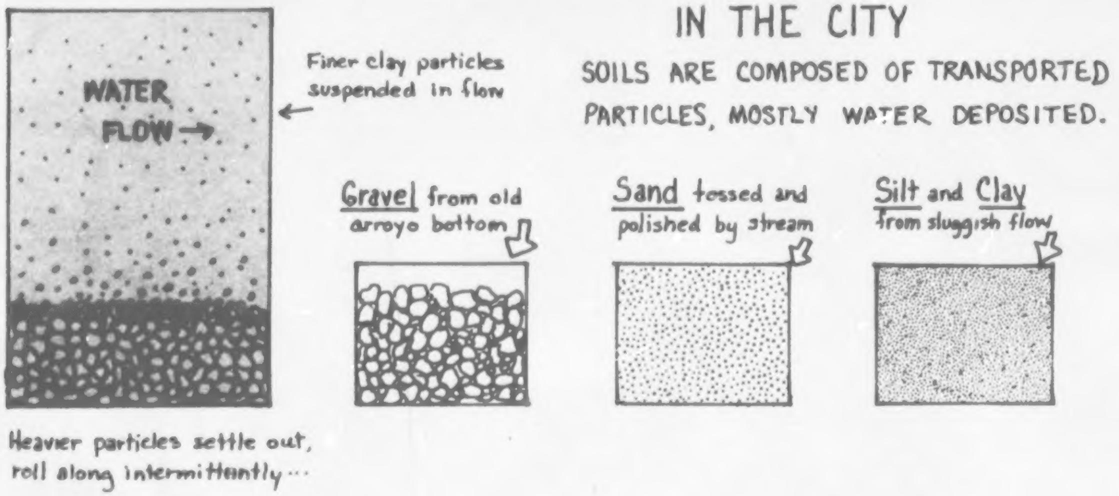
Additional Activities

19. Identify the limiting factors on your school grounds. Design plants and animals that could survive under conditions in which the quality or amount of one of these factors was unfavorable.

    - What are the roles of soil quality, sunlight, temperature, availability of water, and space in determining the kinds and numbers of organisms that can survive in a given environment?
    - What adaptations enable plants and animals to survive in high temperatures? What relationships might exist between an organism's body surface area and the climate? Can you give examples of this relationship?

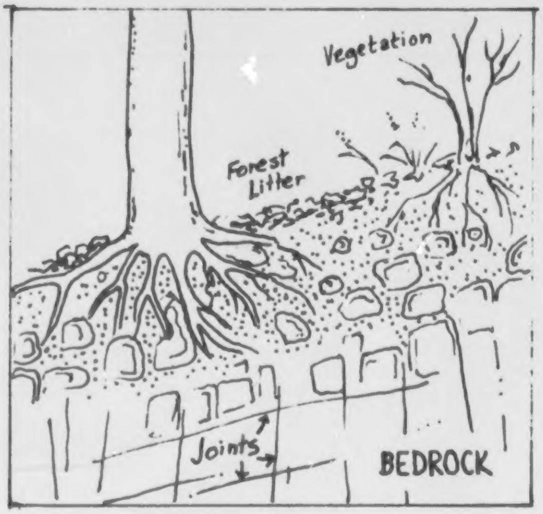
20. Examine a sample of soil from the school yard. (See the illustration below for a comparison of mountain soils and soils found in the city.) Compare this sample with a sample of potting soil. Set up a seed-planting experiment in the classroom using both types.

    - How do the samples compare in texture, porosity, and presence of nutrients?
    - Explain why some types of plants survive better in poor soils than others do.


IN THE CITY
SOILS ARE COMPOSED OF TRANSPORTED PARTICLES, MOSTLY WATER DEPOSITED.
WATER FLOW →
Finer clay particles suspended in flow
Gravel from old arroyo bottom
Sand tossed and polished by stream
Silt and Clay from sluggish flow
Heavier particles settle out, roll along intermittently…

IN THE MOUNTAINS:

Creation of Soil from Jointed Bedrock



21. Observe one small area outside the school for three days. Record the changes and their causes on a chart.

cause / *change*	*seasons*	*weather*	*time*	*oxidation*	*people*	*other*
melting ice						
taller grass						
rusting						

- What changes do you think might occur during the next week . . . few months . . . few years? How do you think this area is different than it was when New Mexico became a state; when the Spanish settlers came; when the Pueblo Indians came?

22. In spring or fall, count the number of seeds from a schoolyard tree which have fallen on one square meter of ground around the tree.

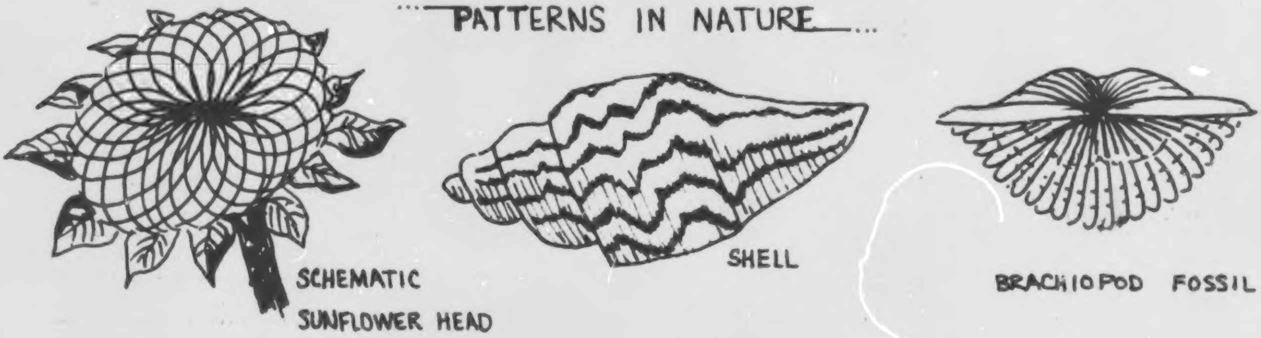
- How many square meters are covered by seeds from this tree?
- Approximately how many seeds came from this one tree?
- What would the schoolyard look like if all these seeds germinated? Why does nature provide such large numbers of seeds? Why do so few become trees?
- What is a population explosion? What happens in human communities when there is a population explosion?

23. Have students conduct research to find out how the utilization of school grounds is determined.

- Are there laws which establish minimum size of playgrounds?
- How can community groups express their views about how school grounds should be utilized?
- How can your class obtain permission to plant a small garden on the school grounds? What factors would you consider before deciding what and how to plant?

Activities for the Senses and Sensibilities

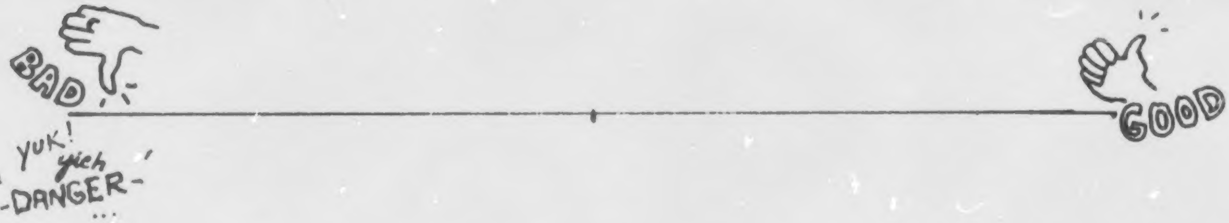
24. Blindfold a partner and lead him or her on a 5-minute walk around the playground (no talking). Each partner lists impressions. After both have finished, exchange lists. Repeat without blindfolds, and with talking permitted.
    - How do the lists compare?
    - What might explain the differences between the lists?
25. Find out how much can be learned by using one sense at a time. Identify objects in a box by using sound, touch, smell. Identify foods through taste with nose and eyes closed.
    - Was any one sense easier to use than the others?
    - Did students find that there were differences among them concerning which senses were the most acute? Discuss.
26. Heighten powers of observation and ability to communicate by making up a "Twenty Questions" game using spring flowers as the objects to be guessed. Clue questions could include: Is it on our school lawn? Does it have a spiny stem? Does it have five petals?
27. Look for "patterns" in the schoolyard (spider webs, flowers, butterflies, caterpillars, soil erosion, rocks). Have each student select a favorite pattern as a basis for designing a textile print.



28. Look at a beautiful tree or a tree-lined street. Elicit "feel" words and list them (majestic, tranquil, towering, graceful, etc.). Have students write Haikus or free verse using some of these words to describe their feelings about having trees around them.
29. Set up a values continuum that we, as thinking people, must oppose. Discuss with students that people have a history of thinking of living things as "good" or "bad" for *them*, and then making decisions based on these judgments.

    Place on the continuum below the general reputation of the following. Discuss.

rattlesnakes
coyotes
land snails
roses
tarantulas
Christmas trees
ponderosa pine
hummingbirds
mountain lions
cockroaches
rats and mice
red ants
cactus
"stink bugs"
Black Widows



30. On a windy autumn day, watch the swaying trees, or leaves blowing through the air, or tumbleweeds bouncing down the street. Have each child identify with, and imitate, one moving object. Choreograph a "ballet" based on movements inspired by these objects. Select suitable music.

PART 2: THE SCHOOL BUILDING

Introduction

Students are the end points of many production/distribution systems, from the bricks in their walls to the paper on their desks. They are also a beginning point of community consumption which creates waste, and the need for waste disposal systems.

An environment, be it a school or a city, can be studied by comparing the quantity, direction, and rate of flow of its various systems, and by noticing how alterations in the design of an environment change these systems.

When the quantity of people increases, the need for support systems also grows. Natural resources are used up at a more rapid rate, and waste products grow proportionately. When the population of an environment exceeds the capacity of its production/distribution/waste disposal systems, an imbalance occurs which can lead to the destruction of that environment.

Building Materials

The newest addition to APS schools are the useful but unattractive, portable steel barracks. Set up or moved quite easily, they accommodate changing enrollment patterns while meeting the required economic and safety standards. Aesthetic considerations are not top priority.

The permanent school buildings, one or two stories, are mixtures of territorial adobe and modern. The older schools are usually characterized by high ceilings, many windows (now being replaced with more durable plastic), too few electrical outlets, and the heating/cooling problems generally associated with older buildings.

For climatic and economic reasons, the newer schools have fewer windows, are concrete and metal (to represent adobe), and contain less visible wood. Carpets often lend texture to the floors, and brightly painted walls are common.

Since most school roofs are flat, runoff drainage areas are often planting spaces for shrubs in order to take advantage of the scarce rainwater. One pitched roof at the Outdoor Education Center is clear-ridged plastic which allows the attic to collect solar-heated air, which is then pushed into the museum by fan. In this case, as throughout the system, materials were chosen for strength, safety, aesthetics, utility, and of course, economy.

Sewage

Sewage is the used water supply of a community, consisting not only of domestic waterborne wastes such as human excrement, ground garbage, and wash waters, but also industrial wastes: acids, oils, greases, and animal and vegetable matter.

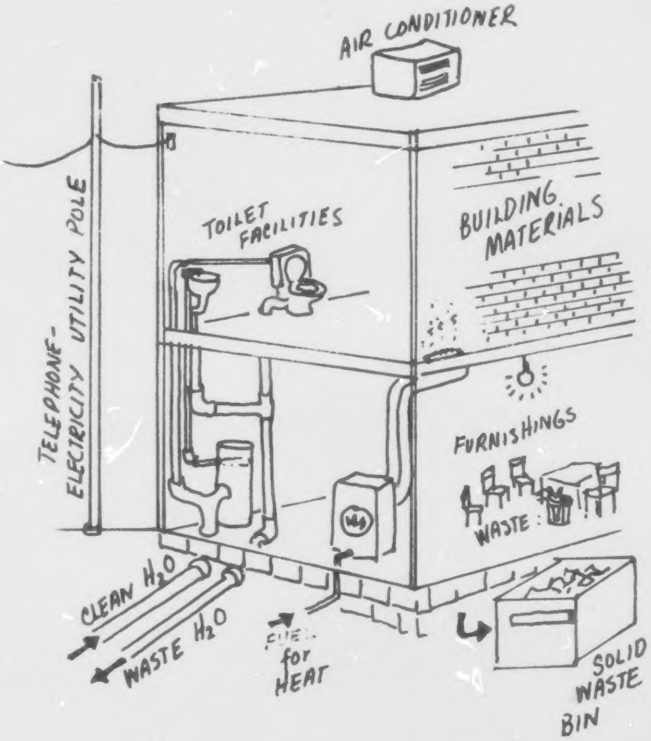
As a potential carrier of pathogenic microorganisms and dangerous chemicals, water may endanger health and life.

Some Albuquerque schools have their own septic tanks with underground drainage fields where natural wastewater treatment (microbial digestion and filtration) takes place. However, the waste from most schools enters the Albuquerque sewerage system which delivers wastewater to the city's treatment plants, located to the south of the city in order to utilize gravity flow. Pretreatment consists of initial removal of solids such as cans, rags, false teeth, gravel, and coffee grounds. Solids removed through pretreatment are disposed of at the sanitary landfill.

Primary clarifiers serve to remove settleable solids, which fall to the bottom and are then routed to the anaerobic digesters. Liquid sewage is then treated biologically at the trickling filters, where it is sprayed over algae-covered rocks in an open tank. Here, in the presence of sunlight and abundant oxygen, algae and other microorganisms (bacteria, fungi, and protozoa) utilize the organic matter for food, causing physical, chemical, and biological changes in the solids remaining. Secondary clarifiers remove solids created at the trickling filters. An activated-sludge process then vigorously aerates the sewage, resulting in a biological floc which is precipitated.

Solid organics taken from the various treatments are routed to the anaerobic digesters, where anaerobic conditions allow other microorganisms to further "digest" the sewage. Pumped to open sludge beds, the sludge is dried by the sun and eventually used to fertilize city parklands.

A by-product of the anaerobic process, methane gas, is recycled and burned to produce part of the energy needed by the plant. The almost 20 million gallons per day of effluent, disinfected by chlorine and discharged to the Rio Grande, is credited to the city's water rights.



Solid Waste

The tons of solid waste produced by the APS schools yearly join the tons produced by the entire city at the city and county sanitary landfills. There the waste is compacted and covered with dirt, and eventually it may become a site for construction.

The APS trash bins are usually located near the school's main garbage source, the cafeteria. The bins are filled with paper, food scraps, and playground litter, and are emptied routinely into the APS-owned dumpster style garbage trucks. Since the solid wastes are not separated, recycling is not economically feasible at present. Given the present number of trucks and drivers, the number of schools and their widespread locations, collecting separate categories of trash would be prohibitively expensive.

Sorting and composting of each school's own wastes is possible, as most school waste is **biodegradable** and could furnish rich soil for sorely needed grassed or garden areas at the schools. (Bernalillo County Agricultural Extension Service has information on composting.)

Electricity

APS uses about 15 percent of Albuquerque's total commercial consumption of electricity; in 1976-77 this consumption was approximately 56 million kilowatt-hours. The electricity used in Albuquerque is mainly generated at two gas-fired plants within the city and at the large, coal-fired plants in northwestern New Mexico—the San Juan and Four Corners Generating Stations. Public Service Company of New Mexico (PNM) owns 50 percent of the former and 13 percent of units 4 and 5 at the latter. If customer demand exceeds the generation capacity of these plants, peaking units in Albuquerque, Santa Fe, and Las Vegas begin operation. Any electricity needed beyond this is purchased from other western utilities.

Albuquerque's stations use relatively non-polluting natural gas. If that fuel is curtailed, the plants switch to low-sulfur fuel oil. Coal cannot be used at these plants because they were designed for natural gas and fuel oil, and retrofitting them to burn coal would be prohibitively expensive. The San Juan and Four Corners plants are exclusively coal-fired, and are equipped with extensive pollution-control devices. Although these devices remove most of the larger particles of solid emissions (fly ash), they are not as effective in trapping the smallest particles which may be detrimental to health.

Each plant has its own surface coal mines on site. The coal is brought to the plants by truck and is pulverized for greater burning efficiency. Within a few years after the coal is mined, the land is refilled, contoured, reseeded, and watered for several years.

Fuel

The fuel supply for your school is probably natural gas used to produce hot air or steam heat. For 1978-79, APS anticipates spending over $1.3 million for natural gas heat. Twelve thousand dollars will be spent for direct electric heat at one mountain school.

To aid your school in reducing its energy consumption, all school principals have available a fuel-use report. You and your class might find this report of value when examining your school environment, or when comparing your school with others that are similar.

Water

Schools located within the Albuquerque City limits obtain their water from wells drilled within the Santa Fe Formation, none less than 150 feet, to eliminate the possibility of surface contamination. Some APS schools have their own wells. Automated electric pumps draw the water up to the surface where it is chlorinated and stored in above ground tanks. Booster pumps serve to keep all reservoirs supplied and water pressures adequate. Reservoirs are located uphill from water users, utilizing gravity to maintain the flow to the school.

Located in a semi-desert area with considerable variation in surface water volume, the City of Albuquerque is dependent on underground supplies, fed from New Mexico and Colorado mountain runoff. Water is mined from approximately 80 municipal wells, and numerous irrigation, domestic, and stock wells. (Specific information about water supply for a particular school can be obtained by calling APS Maintenance Operations, 765-5950, ext. 224.)

Supplies

One of the systems supporting your school deals with instructional supplies, the materials labeled "consumable." Listed under 32 categories, which include arts and crafts, physical education, welding gases, and miscellaneous, are the papers, pencils, glues, games, and music that teachers and students work with daily.

Ordered through the APS warehouse, the cost of these materials is more than $2 million per year, an amount to keep in mind when talking with your class about conservation, producers, and consumers, or consumer economics.

Textbooks, with new adoptions every few years, are budgeted for over $1 million, while instructional support supplies and materials total another $1 million. These supplies include audio-visual materials, library books, and bilingual materials. (Your school principal will have a copy of the budget available in which you may find information pertaining to your school.)

SUGGESTED INFUSABLE AREAS OF THE CURRICULUM

Grade	*Subject Area*	*Topic*	*Activities*
K-1	Social Studies	*Orientation to the Physical Environment: My Responsibility in Small Group Living:* the school community	1, 5, 13
2	Social Studies	*City of Albuquerque:* natural resources of the area	2, 4, 8, 12, 15, 16
3	Social Studies	*Comparative Studies of Cultures:* conservation of natural resources; architecture	1, 4, 6–9, 11, 13, 14
4	Social Studies	*Southwest Region:* the manner in which people make a living is affected by the land and their manner of making a living affects the land	2, 4, 15, 16
4-12	Art	Explore and use found materials to produce environmental design; know and design aesthetically pleasing architecture; know how to develop and preserve aesthetic or historic architecture	1, 2, 4, 5, 7
5	Social Studies	*Geography of New Mexico and the Southwest:* control of natural resources	2, 4, 6, 8, 9, 11–13, 15, 16
6	Social Studies	*Development of State Government:* city government	3, 14
	Science	*Ecosystems:* pollution	13, 14
	Science	*Middle School Science Curriculum:* I. 3. o. Pinwheel, Windmill, and the Wind III. 5. b. What Is Biodegradable? 5. g. Greenhouse Effect 6. c. The Study of Fossils 6. d. Making Fossils IV. 1. b. It's a Scorcher V. 3. b. Conservation of Heat Energy VI. 1. a. Technology in Your City (waste) 1. b. Technology in Your City (electricity) 1. c. Building a Structure	9–17
HS	Science	*Environmental Science:* energy alternatives; solid waste pollution	
		Applied Chemistry: fuels and heat energy; plastics	
		Physics: nature and source of heat energy; direct current circuits; nuclear energy	

RESOURCES

Gas Company of New Mexico. *Consumer's Guide to Energy Conservation.* Albuquerque, NM.

New York State Education Department. *Living Within Our Means: Energy and Scarcity, K-6* and *7-12.* Albany, NY: 1974.

Terry, Mark. *Teaching for Survival.* New York: Ballantine Books, 1971.

Trogler, George E. *Beginning Experience in Architecture.* New York: Van Nostrand Reinhold, 1972

EYE-OPENER WORKSHEET 5: A CLOSER LOOK AT YOUR SCHOOL

Answer the questions below after you have examined more closely the physical characteristics of your school.

- Check all of the words or phrases which describe your school building. ______ One story high. ______ Two stories high. ______ Many windows. ______ Few windows. ______ New. ______ Old. ______ Very old.

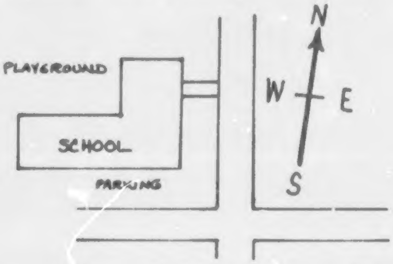
  If you checked "old" or "very old," list five things which made you do so.

  ______________ ______________ ______________ ______________ ______________

- Circle the compass direction which indicates the direction that *most* windows face and *underline* the direction which your own classroom windows face.

  N S E W NE NW SE SW

- Illustrate the compass orientation of your school building with a sketch similar to the one below.



- Is your school air conditioned? ______ Yes ______ No ______ Partly

- Which building materials cover the outside of your school? ______ Adobe ______ Stucco ______ Brick ______ Concrete block ______ Other ______________________________

- In what style of architecture is your school built? ______ Southwestern ______ Modern ______ Other (Describe) ______________________________

- Check the other materials that were used to build your school:

  ______ glass ______ limestone ______ fieldstone ______ steel
  ______ wood ______ granite ______ marble ______ tile
  ______ aluminum ______ slate ______ terrazzo ______ others ______

- Does your school building blend in well with its natural surroundings?
  ______ Yes ______ No Comments ______________________________

- Does your school building blend in well with the buildings around it?
  ______ Yes ______ No Comments ______________________________

- Do you think the design of your school building is attractive?
  ______ Yes ______ No If not, what could have made it more so?
  ____
  ____

- Do you think your classroom is attractive? ______ Yes ______ No
  If not, what could your class do to make it more so? ______________________________
  ____

ACTIVITIES

Eye-Opener Activities: 5

1. Have students work in small groups to design an "ideal" school, keeping those features of your school which are considered desirable. Consider such factors as: general architectural style, orientation on plot, number and placement of windows, number of stories high, construction materials, and use of air conditioning. Draw designs for, or models of, the "ideal" school.
   - How does the architecture relate to the available space, the geography, and the climate?
   - To what standards must architects conform concerning space per student and lighting in terms of room size and use? Does the school meet these standards? Does the "ideal school" meet these standards?
   - Which groups' designs are most attractive? Why? Which are most functional? Which are best for energy conservation? Which are most cost-effective for Albuquerque? What factors are included in the determination of cost efficiency?
   - What facilities or provisions are included in these designs which are not in the existing building? What advantages do they provide? What, if any, disadvantages do they present? What is your cost/benefit analysis of these new facilities?
   - Does the new design include air conditioning? If so, does it include windows? Do the windows open? How does it feel or might it feel to spend a day in a building with few or no windows? What are the pros and cons of air conditioning?
   - Which objects in the new design are functional? Which are decorative? Which are both?
   - Which construction materials are most suitable for the exterior of a school in Albuquerque? Why?
   - What provisions do the designers make for maximum benefit from solar energy? What provisions for insulation?
   - How would changes in the number of students and traffic flow alter these designs? Sketch how these changes might be accommodated.
2. List the primary building materials used in the construction of your school. On a map of the United States, pinpoint the sources of supply for each of these materials.
   - Which of the materials used can be obtained locally? Where do the others come from?
   - Select one type of construction material used and describe the steps involved in manufacturing and transporting it to the school site.
3. Conduct research (interview parents, old-time residents, the custodian; examine historical records) to find out something about the school's origin.
   - When was the school built? Why was it built at that time?
   - Why was this site selected? Who made the selection? Was it a good choice? Why? Did the community have any voice? Does it nowadays? What was this land used for before the school was built?
   - What other construction went on at that time in the city? How did the architecture and construction materials of the school compare with other buildings of that era?
4. Set up a display of construction materials used for the exterior of buildings in Albuquerque (adobe brick, wood, red brick, cinder block, stucco, etc.). Prepare a chart to accompany the exhibit.

Construction Material	*brick*	*wood*	*cinder block*	*others*
Raw Materials Source of Raw Materials Availability (good, poor, etc.) Mfg. Process Involved Mode of Transport Cost (high, med, low) Environmental Impact				
Desirability Rating				

5. Discuss with students the functions and purposes of a classroom. Include in this discussion how the classroom environment affects the quality of the education going on in the room. Elicit suggestions for changes in the way your room is set up which could benefit the class. Discuss students' reactions to these ideas. Try some of them.

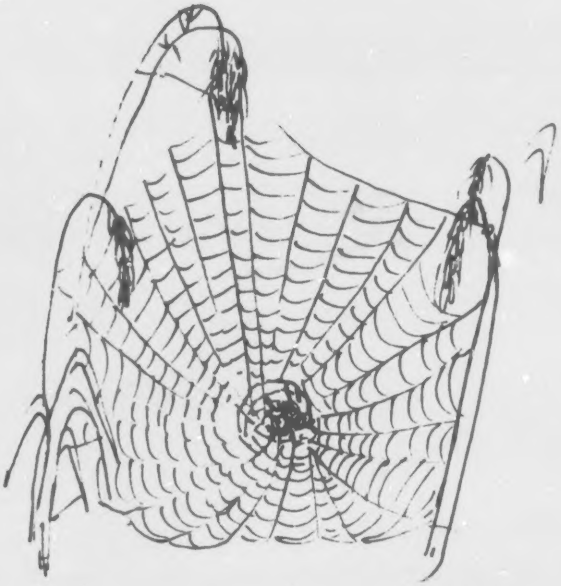
- What factors should be considered in room arrangement (appearance, class and room size, traffic flow, optimum use of light, opportunity for ''corners,'' privacy, etc.)?
- Can the class do without any of the ''fixtures'' of the classroom? (blackboard, bookcases, library table, etc.)
- Is there an emotional environment in the classroom? If so, how does the physical arrangement affect this environment?
- What aspects and items of the room contribute toward achieving the agreed-upon purpose of a classroom? How? Which do not? Why?
- To what extent does class size determine the way the room is arranged? What modifications would be necessary in the most preferred arrangement if class size increased?

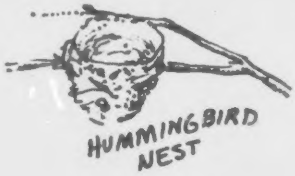
6. Prepare a bulletin board display or a flannel board story to illustrate the theme that ''Everything Comes From Nature.'' Select a variety of common articles used in the classroom and trace them back to the natural resources from which they came.

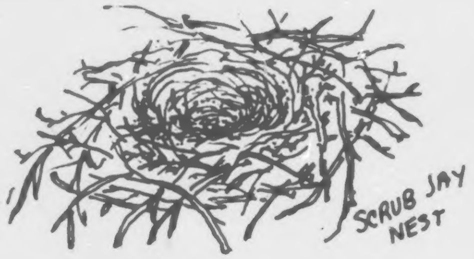
- Which of these resources are **non-renewable**? Which are **renewable**? How long does it take to renew some of these resources?
- Which of these products can be reused, recovered, and/or recycled?

7. Compare the shapes of animals' structures and ''homes'' to those made by humans. Set up a picture display.

- Are animal structures generally round or angular (birds' nests, spider webs, cocoons, ant hills, etc.)?
- How are most human-made buildings shaped?
- What examples can you find of human use of round structures? (hogans, igloos, Astrodome)
- What are the advantages of round structures and of rectangular structures?







EYE-OPENER WORKSHEET 6: WHAT IS YOUR SCHOOL'S IMPACT ON THE ENVIRONMENT?

Arrange with the principal and the engineer/custodian to study the operation and maintenance of the school.

Heating

- What type of heating system is used? ______________________

  How often is it inspected and serviced? ______________________
  Is there a more efficient one that could be used? ______________________
  If so, what prevents your school from using it? ______________________
  ____

- What type of heating fuel is used? ______________________
  Where does it come from? ______________________
  How does it get to the school? ______________________
  What, if any, adverse impacts does use of this fuel have on the environment? ______________________
  ____

- Does the school have an air cooling system? ______________________
  If so, what kind? ______________________

- Can each room adjust its own thermostat for heating? ______________________
  For cooling? ______________________

- Are empty rooms heated? ______________ Air-cooled? ______________

- Does the school have adequate insulation? ______________________
  Could the doors and windows be caulked to avoid heat loss? ______________________

- How much energy does your school use per month to heat the building? ______________
  To cool it? ______________ How much money does it cost APS to heat your school? __________

Lighting

- Can the lights be regulated in each room? ______________________

- Are the lights left burning in the cafeteria? ______________________ In the auditorium? ______________ In the corridors? ______________

- Is natural light sufficient most of the day in some classrooms? (The Department of Energy recommends lighting levels of 50 footcandles at desks; 30 footcandles in rooms and work areas; and 10 footcandles in halls and storerooms.) Use a light meter to determine the amount of light in different parts of your room and school: desks near window______; desks away from window ______; work areas ______; halls ______; cafeteria ______.

- What is the wattage of the light bulbs in your classroom? ______________________
  Calculate the kilowatt hours of electricity used by all of these bulbs in your classroom in a week ______________. For the school year ______________.

After School Hours Use of Heat and Light

- Is the building used between 4 p.m. and 6 a.m.? ____________________
  If so, how? ____________________
- How much of the total energy consumed by the school is used after school hours? ____________________
  ____________________ How can you find out? ____________________
- How much energy do you think your school wastes in its use of electricity? ____________________
  What percentage of the total consumption is that? ____________________%
  What percentage of heating fuel is wasted? ____________________%
  How did you make this determination? ____________________
  What are the adverse environmental impacts of overconsumption of electricity? ____________________
  ____

Water

- Make an inventory of all the ways water is used in your school building and on the school grounds, and list those used on the back of the worksheet.
- How much water does your school consume in one month? ____________________
  How much water is that per capita? ____________________ Is more used some months than others? ____________________ If so, which months?
  ____________________ Why? ____________________
- If your school has a paved parking lot, what impact does that have on the water cycle and water availability? ____________________
  ____

Paper

- List (on the back) all the ways you can think of that paper is used in your school.
- Ask the principal, or teacher in charge of ordering supplies, how much paper is used each year for classroom and office purposes. ____________________
  ____
  Ask the custodian how much paper is used in the cafeteria and for maintenance. ____________________
  ____
  Name other paper products that are brought into the school. ____________________
  ____
- How many times could the exterior of the school building be covered with the paper that is consumed within a month's time? ____________________
- Ask the custodian how much solid waste is generated in the school in a year. ____________________
  What percentage of this solid waste is paper? ____________________%
- Do a survey to get a variety of opinions about what percentage of the paper thrown away was unnecessary. Ask the principal, the custodian, a few teachers, and several schoolmates. Record their answers.

- List all the ways you can think of that paper consumption has an impact on the environment. Discuss your answers with your classmates.

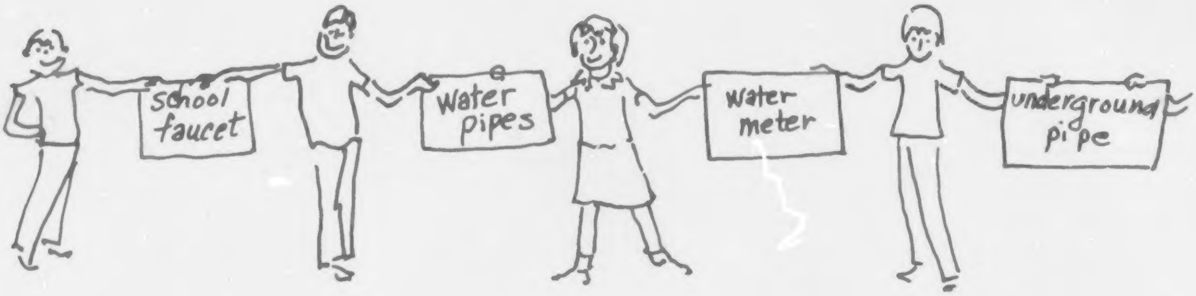
How Can You and Your Class Combat Overconsumption?

- List three ways each that you can help to conserve: (1) energy used for heating and cooling; (2) energy for lighting the building; (3) water; and, (4) paper.

Heating	Lighting	Water	Paper
(1) ____________	(1) ____________	(1) ____________	(1) ____________
(2) ____________	(2) ____________	(2) ____________	(2) ____________
(3) ____________	(3) ____________	(3) ____________	(3) ____________

- How can your class encourage the school to cut back on its resource consumption by 20 percent? (Explain in the form of a brief essay, or sales pitch.)

8. Set up a "human chain" to demonstrate what happens when you take a drink from a water fountain. Ask questions, working backward from the water fountain, until the entire water cycle has been traced.
   - How did the water get into the water fountain?
   - How does the water get into the pipes?
   - How does water get into the school?
   - How does water get to the school?
   - Where is the city's water stored?
   - How does it get there?
   - Where did that water come from?



9. Use a magneto (model generator) to discover how electricity is generated.
   - What is the source of energy used to generate electricity in the magneto?
   - What source(s) does Public Service Company of New Mexico use?
   - What environmental problems are connected with the use of fossil fuels? What is being done to try to solve some of these problems?
   - What is meant by the "energy crisis?" What is the outlook for the future?
   - What alternative sources of energy for electricity are being studied? What are the pros and cons of each?
10. Develop a diagram to trace the path of electricity from the wall outlet in your classroom back to the generating plant.
11. If a storm caused a temporary "blackout" during school hours, how would this affect your class and the school? List all the uses of electricity you can think of in the class and school.
    - Which of the uses of electricity are most important and would be missed the most? Which could be done without most easily?
    - How might the class improvise during the blackout?
    - How might parents be affected by the same blackout at home or their places of business?
    - Have we become too dependent on electricity? If so, are there things we can do about it short of turning the clock back by a century? Keep a record for one day of the electricity you, yourself, used at home. How much wattage did you use? ______________________________
12. Discuss how you would answer the question, "What is the air temperature now?" Is there any one answer to that question? Explain.
    - What is the temperature in different parts of your room? (Near the floor; near the ceiling; in a closet; in the sunlight [shield the bulb of the thermometer from the direct rays of the sun]; near the window, but not in the sunlight.) Explain. Graph the temperature at hourly intervals throughout the day in a given part of the room.
    - How does the temperature differ in rooms on the south side of the school from the north side? Why? Graph the temperature at hourly intervals in rooms on both sides of the school.

- What is the air temperature inside a sunlit box covered with black paper? white paper? aluminum foil? Explain.
- How does the temperature inside the school differ from the temperature outside? What different temperatures do you get outside the school? Does the side of the building (north, south, east, west) matter? Does the time of day matter? Is the temperature different under a tree? If so, why? (Consider transpiration as well as shade.)
- How can the data collected in this investigation be used to help demonstrate energy conservation measures? How can it be used to demonstrate how energy is often wasted?

13. Inventory the waste accumulated by your class by the end of the day. Use both the contents of the wastebasket and the litter strewn on the floor. (Discuss the fact that both collections constitute SOLID WASTE, the only difference between them being that the wastebasket is a tidier way of disposing of discards than littering.) Prepare a chart of your itemized findings for a week. Determine a per capita figure. Show the results in a circle graph.

- Which category forms the largest part of your class' solid waste? Are there ways to cut down? Try different methods suggested by the class, and compare the quantity of solid waste after trying for a few days.
- Which of the discards should never have been thrown away, and should be *recovered?* Which can be *reused?* Which should be *recycled?*
- Which of the wastes decompose after a few days? Which decompose after a few weeks? What does "biodegradable" mean?
- Which presents a greater solid waste disposal problem, biodegradable or non-biodegradable items? Explain.
- What part of the waste is the result of overpackaging? What part is the result of discarded objects which could be further used? What are some reasons for excessive packaging? Which of these reasons might be justified considering the realities of our current lifestyles and social problems? What role does advertising play?

14. Talk with the custodian to learn what is done with the wastes produced in the school. Trace the system used for solid waste disposal in Albuquerque. If possible, take a trip to sanitary landfill sites, and to places where illegal dumping occurs.

- Does the school cafeteria use washable or disposable dishes and utensils? If disposables are used, what trade-offs are involved? What economic, sanitary, and environmental factors must be considered in determining whether disposables should be used?
- What, if any, problems does solid waste collection and disposal present to the city and county? How much of the city's total budget is allocated to solid waste collection and disposal? How much of this cost could be eliminated by decreasing our consumption of goods?
- How does Albuquerque's solid waste disposal costs and problems compare with that of other cities? What effect, if any, might a sudden and large increase in the city's population have on the solid waste disposal system in Albuquerque?
- How does consumption of goods per capita in the United States compare with that of other developed countries? With developing countries?

Additional Activities

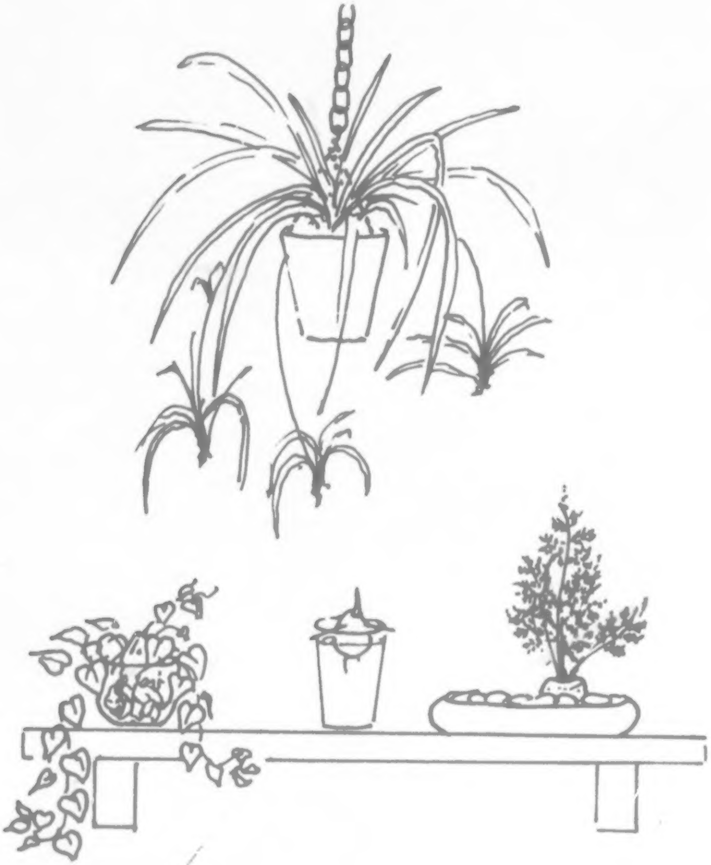
15. Conduct research to find out which of the alternative sources of energy are especially related to Albuquerque, or nearby parts of New Mexico.

- What is the current status of geothermal research? What geological conditions are needed for collecting geothermal energy? How close to Albuquerque might a geothermal station be safely constructed?
- What is being done in and around Albuquerque about solar energy research?
- Would wind energy be practical in Albuquerque? How much wind is there in the area? Is it predictable? When is there wind? What causes wind? What parts of the city have the most wind? Why? Use the Beaufort wind scale to determine wind velocities for a given period. Record your findings. Compare with weather reports.
- What effect might increased mining of uranium have on New Mexico? What would be the effect, if any, on Albuquerque? (Consider social and economic effects as well as effects on the physical environment.)
- What is "**biomass**?" How is the term applied in connection to alternate sources of energy?

16. Discuss the statement, "There are untapped oil deposits in the Albuquerque area."
    - What is a fossil fuel? Which fuels are considered fossil fuels? Are similar conditions found around Albuquerque? If so, where?
    - Are any other fossil fuels found in the Albuquerque vicinity? If so, which? Locate them. Are there plans to mine them? If so, what economic, social, and environmental impact would this have on the area?
17. Discuss the contention that all sources of energy are basically "solar energy." Trace each of the major energy resources back to its origin. (Include diagrams showing energy transfer where applicable.)

Activities for the Senses and Sensibilities

18. Make "art" out of otherwise useless pieces of trash.
19. Have a "Recycling Fair" featuring new uses for discards.
20. Encourage children to use their imaginations and describe familiar classroom objects in creative ways. (Example: a spider plant was described by a second grader as an "octopus in a bed of seaweed.")
21. Beautify your classroom by adding plants. Make a "kitchen garden." Plant avocado seeds, sweet potatoes, carrot tops and onions.



PART 3:

THE PEOPLE OF THE SCHOOL COMMUNITY . . . AND THEIR SOCIAL STRUCTURES

Background

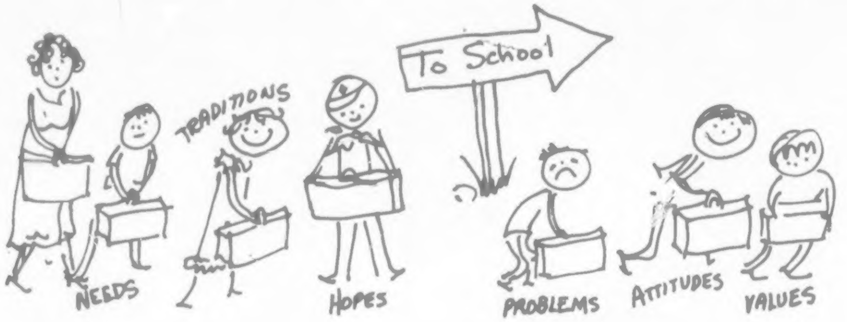
The APS community has over 60,000 students and approximately 6,000 employees; more than one-sixth of Albuquerque's total population. Each one of these persons gets up . . . washes . . . dresses . . . eats . . . goes to school . . . uses fuel . . . water . . . food . . . roads . . . needs stores . . . power lines . . . sewage systems . . . parking lots . . . Yet, every one of them is a **me**

. . . having his or her own physical and emotional, inner environment; an environment which revolves about him or her . . . interacting with every other ME and the total environment.

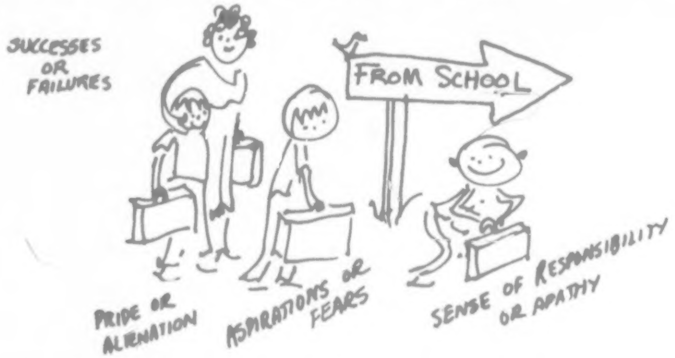
"To the other guy, you're the other guy."

"Cada cabezoes mundo." ("Each head is a world.")

Everyone comes to school carrying parts of his or her environment.


To School
TRADITIONS
NEEDS
HOPES
PROBLEMS
ATTITUDES
VALUES

. . .everyone leaves school carrying away the end products of the school's impact.


SUCCESSES OR FAILURES
FROM SCHOOL
PRIDE OR ALIENATION
ASPIRATIONS OR FEARS
SENSE OF RESPONSIBILITY OR APATHY

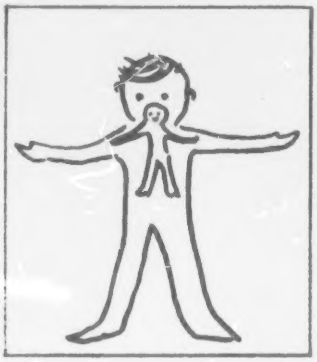
Each school is a community within a community. As in all communities, every living thing has a niche: its own function, and its own place in which to function . . . student . . . principal . . . assistant principal . . . librarian . . . dietician . . . custodian . . . nurse . . . counselor . . . coach . . . teacher . . . parent

Each school community has its own government and social structure as well as sub-governments and sub-environments involving . . . rules . . . actions . . . decisionmaking . . . enforcement.

Opening "My" Eyes

The approach used in the Eye-Opener Worksheets and Activities which follow is different from that used previously, but the basic message is the same. Humans have become increasingly incapable of living in harmony with their environment. It is essential that we establish humans as a *part* of nature, not its masters. We must examine the damage done to our environment as a result of the anthropocentric view of the world which evolved along with our technological society.

The orientation of this part of Section III, however, is deliberately anthropocentric and egocentric. The student is encouraged to look at two environments, the world around him, and his inner physical and emotional environment from a "ME" centered point of view.



The rationale for such an about-face in this one part of the book is that it is important for students to look from behind their eyes outward, and inward; to see themselves and their relationships to their total environment with heightened awareness. The more self-understanding they can achieve, the better they will be able to relate to the world around them. The higher their self-image, the greater the possibility that they can acquire a feeling of stewardship for their environment.

The interactive role of environment and self-image is something with which we are all familar. Our feelings about ourselves are colored by the physical and psychological atmosphere in which we live. Conversely, our feelings about, and actions toward, the people and things in our surroundings are frequently affected by how we feel about ourselves. It is this interrelationship that "The People of the School Community . . ." is addressing.

With every student being at the center of a series of concentric circles, the projects and activities suggested here prompt each one to focus on his role and relationships in all of the communities of which he is a part: body; family; class; school; the neighborhood; the city; and society beyond the city. The learnings from such studies can be enlightening, puzzling, and even disturbing. *The need for introducing these activities with sensitivity and understanding is obvious.*

The Eye-Openers in this part of the book, and the activities related to them, view the student's relationship with his surroundings from four perspectives:

- ***Eye-Opener 7: "How Does The Community Serve You?"*** The student considers the societal systems which supply his needs and wants during an average day, and learns to differentiate between needs and wants.
- ***Eye-Opener 8: "ME"*** Each individual looks at himself and the things around him which affect how he feels about himself and his life. He develops understandings of the psychological workings of his "inner environment," and, it is hoped, grows in acceptance of himself and others.
- ***Eye-Opener 9: "How Well Do You Treat Your 'Inner Environment'?"*** The student becomes aware of another part of his inner environment—the physical. He gains insight into his responsibility to be an alert consumer and a steward of a very special environment—his own body.
- ***Eye-Opener 10: "How Can You Get Something Done?"*** The egocentric approach of the previous Eye-Openers is broadened to provide understanding of the other "ME's" in the school society. Their **niches** and problems are examined, as are the interrelationships which weld the various individuals into a smoothly functioning community.

SUGGESTED INFUSABLE AREAS OF THE CURRICULUM

Grade	Subject Area	Topic	Activities
K-1	Social Studies	*Family Life in New Mexico: My Responsibility in Small Group Living:* the school community	9, 11, 13–15, 24, 29, 30
1	Science	*Organisms:* food webs	22
2	Social Studies	*City of Albuquerque:* division of labor; community helpers	3, 4, 5, 30
3	Social Studies	*Comparative Studies of Cultures:* political and social structures	3, 5, 26–28, 30
4	Social Studies	*Interesting People:* why certain people become very important to their social group	7
	Science	*Environments:* an organism's environment	1, 3, 9, 17–20, 22–24, 26, 27
5	Social Studies	*Interesting People*	7
	Science	*Communities*	3–5, 26–30
6	Social Studies	*Development of State Government:* city government	3, 5, 6, 26, 28, 30
		Roots: "How have people of New Mexico influenced each other?"	2, 4, 5, 14, 21, 23, 26, 30
	Science	*Ecosystems:* "inventing" ecosystems	30
		Middle School Science Curriculum	1–3, 17–25
		II. 4. g. Building a Lung	
		4. h. Lung Capacity	
		6. d. Desirable Characteristics	
		III. 2. a. Starch	
		2. b. Changes in Starch	
		2. c. Breaking Down A Complex Sugar	
		2. d. Nutrient Tests	
		2. e. Are You What You Eat?	
		2. f. Diets and Health	
		2. g. Rat-Pak	
		2. h. Your Calories Are Showing	
		3. e. Studying Your Teeth	
		3. f. Keeping a Health Record	
		3. i. What is Normal?	
		5. e. Noise Pollution	
		5. f. Noise Pollution (cont.)	
		8. a. Testing Your Heart	
		8. c. Importance of Eating Correctly	
		9. a. Food Chains	
		9. b. You Are What You Eat	
		9. c. Primary Foods	
		10. b. Under the Influence	
		VI. 2. d. Constructing a Flow Chart	
7	Social Studies	*Universals:* food and eating habits; social customs	1, 2, 5, 17–23, 26
HS	Social Studies	*History of Minorities:* cultural values	1, 23, 26, 28
		Sociology: social organization; social institutions	5, 23, 26, 27–30
		Social Psychology: human behavior including personality, conflict, stress, feeling, emotion, and development	7, 9–11, 14, 15, 27

Science	*Biology I:* human systems, digestion and nutrition; circulation; respiration; nervous control; behavior (animal, including man)	3, 7, 10, 14, 17, 18, 20–22, 25
	Consumer Biology: doing their thing; food	17–25
	Environmental Science: noise pollution	24
	Applied Chemistry: chemistry in the home; food additives; soaps and detergents	17, 18, 25

RESOURCES

Dodder, Clyde and Barbara. *Decisionmaking*. Boston: Beacon Press, 1968.
Halperin, Lawrence. *RSVP Cycles: Creative Process in the Human Environment*. New York: George Braziller, Inc., 1969
Sommer, Robert. *Design Awareness*. San Francisco: Rinchart Press, 1972.
Terry, Mark. *Teaching for Survival*. New York: Ballantine Books, 1971.

EYE-OPENER WORKSHEET 7: HOW DOES THE COMMUNITY SERVE YOU

How are you linked to the larger community around you? Think of the many things you do each day and list them in the first column. For each one, give the name of a service the larger community provides you, using the second column. Finally, list the natural resources which enabled you to perform each activity.

Daily Routine/Activity	*Link to Community*	*Natural Resources*	*Rating*
1. wakened by clock radio	Public Service Co. of New Mexico	fossil fuel	
2. showered	Department of Water Resources; Sewage Disposal Plant	water; energy to heat water	
3. dressed			
4. ate breakfast			
5. walked to school			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

- Rate the natural resources you used according to their importance to you (1—vital; 2—important; 3—optional) by placing the appropriate number to the right of the third column.

- How would your normal life be affected by a water shortage; flood; truckers' strike; gas shortage; doubling of the number of cars in Albuquerque? Select the one you think would affect you the most and write about it.

ACTIVITIES

Eye-Opener Activities: 7

1. Divide the class into three groups. Have one group list the needs of plants, one, those of animals, and one, those of people. Make a pictorial chart.
   - How are the needs in all three groups similar?
   - What are some needs people have which plants and animals do not share?
   - Which human needs might vary according to people's customs and personal tastes?
   - How can needs and wants be differentiated? Is this easy to do? Explain.
   - How well are the students' needs met in their personal environment? What might be some reasons which explain why some students' needs are not met as they would like?
2. Highlight the staggering demands our current lifestyle makes on energy from fossil fuels. Decide on a sample breakfast which might have been eaten either by the early Indian and Spanish settlers or by the students in the class. List, in three columns, the energy used to get these foods on the table in each instance.
   - What was the major energy source used by the early settlers in planting and harvesting their crops? What energy is used today?
   - How much of the food eaten by the early settlers was homegrown? How much is homegrown nowadays?
   - In what different ways does the transportation of foods require the use of energy?
   - How does packaging food use energy? Why does the use of plastic products for packaging use more energy than paper-packaging?
   - What are the differences between energy consumption for home storing of foods then and now? Of cooking?
3. Cities are sometimes described metaphorically in terms of energy requirements and vital systems of the human body. List the parallels that occur to you in a chart like the one below.

Human Body	*City*
1 *arteries* as conduits for blood	highways as conduits for moving people, goods
2	
3	
4	

   - What changes would occur in any one of the human systems if the quantity, direction, or rate of flow of any of its components was changed?
   - What parallels would occur in a similar system in a city?
   - How might changes in any one of the human body's systems affect another part of the body?
   - What parallels might occur in a city ecosystem?
   - How would you explain the facetiously used term, "autoriosclerosis?" Is there any danger Albuquerque might approach that condition?
4. Play an *Environmental Effects Game:* "What would happen if . . . ?" Students sit in a circle. One is given a question to ask the group. Children express consequences by turns. When three children in a row "pass," a new question is used. Sample questions might be:

   . . . if all of the workers in Albuquerque traveled to and from work on motorcycles?

   . . . if all men, women, and children could walk to their places of work, and to stores, schools, etc.?

   . . . if all garbage men went on strike during June, July, and August this summer?

   . . . if the water table dropped 1,000 feet?

   . . . if all the people in Albuquerque decided to move to the Sandia Mountains?

   Have children think of additional questions to use.

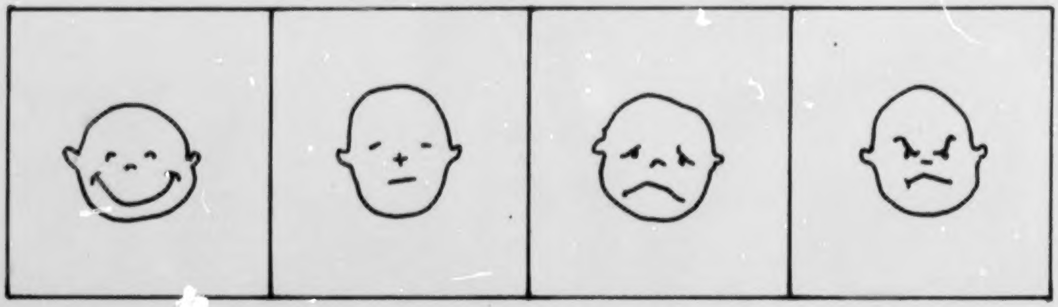
5. Put together an imaginary day in the life of a family in Albuquerque (present or past): Hispanic/ Native American/ Anglo/ Black; urban/ semi-rural; wealthy/ poor; residents of the North Valley/ South Valley/ Northeast Heights/ Downtown.
   - What are their needs? Wants? Hopes?
   - What city services do they use? (Consider social services as well as basic physical services such as water, electricity, etc.)
   - To what extent do they function as neighborhood groups in expressing a need for services? To what extent to they feel neighborhood ties?
6. Using bus route maps and a city map, show how your class can take interesting field trips on public transportation.
   - What are some places your class can visit to see the kinds of services the city offers?
   - What are the advantages of using public transportation rather than parents' cars for these trips?

"Everything is connected to everything else"—Barry Commoner

EYE-OPENER WORKSHEET 8: "ME"

This is a very important Eye-Opener, about a very important environment—YOURS—the environment inside your head and your body. This Eye-Opener is about you, and it's for you. Don't share it with anyone unless you really want to. After you have finished writing, you may know yourself a little better.

- List at least five things you do or like which make you feel happy and relaxed.
  ______________ ______________ ______________ ______________ ______________
- Do you get a chance to do these things very often? _____ Why or why not? ______________
- List five places in which you like to be.
  ______________ ______________ ______________ ______________ ______________
- List five words you would use to describe yourself.
  ______________ ______________ ______________ ______________ ______________
- What do you like most about yourself? ______________________________
- Circle the face sketched below that best describes how you feel most of the time.



- Some people are hard on themselves. They expect themselves to be perfect, and that's hard to be! These people have trouble liking themselves. What about you? Check (√) the statement which shows how much you like yourself.

  ( ) always like myself a lot
  ( ) usually like myself a lot
  ( ) sometimes like myself a lot
  ( ) get angry with myself a lot

- What are some of the things about your friends that make you like them? ______________________________
  ____
- If you could have three wishes, what would you ask for? ______________________________
  ______________________________ ______________________________
- Do you think people act differently depending on how they feel? _____. Does that include adults, too? _____ How about you? _____
- For each of the following questions, answer "yes," or "no," or "sometimes." Do you act differently when you are unhappy and when you are happy? _____ When you are angry? _____ Embarrassed? _____ Proud of yourself? _____ Relaxed? _____ "Uptight?" _____
- Do you think your answers on this page would be different if you were in a different mood?

7. Use the preceding Eye-Opener to roleplay. Complete the worksheet again, this time pretending to be any other person: a basketball star; the President of the United States; a TV star; a classmate; a teacher; or, an Albuquerquean from a different part of town, a different time, or a different cultural background. Share and discuss the answers.
   - What factors make the imaginary "ME" the kind of person he or she is?
   - Which of the imaginary persons feel good about themselves? Why?
   - When people feel good about themselves, how are they apt to treat the things and people in their environment?
8. Teachers and students can become better acquainted with themselves and each other by making "Me Charts."* Use large pieces of newspaper or poster board for each person. In the center of each chart, place a picture or symbol to represent the "Me." Add pictures, symbols, or real objects to the chart to represent the people, things, ideas, feelings, interests, and values which are important to the person making the chart. Display the completed charts, and talk with each other about them.
   - Does anyone add or take away from his chart as the term progresses?
   - What changes, if any, do people notice in themselves? In each other?
9. Explore ways of increasing your awareness of how your body and your environment interact.
   - How many different ways are there of getting from one part of the room to another? (walking, crawling, skipping, meandering, others) Does the size of the room influence the way you feel like moving? If so, how?
   - How do you feel when you pass one person as you move across the room? Two people? Many people? Does it matter how close you are to the person (people) when you pass?
   - Does the amount of "territory" you want and need differ depending on how you feel? If so, how do you feel when the territory you want is small? Big? How much territory do you want now? Use a piece of chalk to mark it on the floor.
   - Can you feel your "space bubble" (an imaginary spatial projection of "where you are at" emotionally at any given time)? Let your body move in that space bubble. Can you remember what your space bubble feels like when you feel differently about yourself?
   - How would you walk if the ground were icy? If it were cold outside? If it were a beautiful day outside and you didn't feel like going inside? If you were angry? If you were happy?
   - FREEZE! How do you feel when another person walks past you while you are "frozen?" Walks around you? When everyone else walks around or past you? When you walk past other people who are frozen?
   - How do other people you know walk? Does the way they walk reflect their personality? Does the way they walk change depending on their mood? On where they are going? (Does yours?) What can you learn about strangers by watching how they walk?
   - How can you use body movement to show how you feel? Make up a "dance" (body-movement improvisation) in your classroom; in the gym or cafeteria of the school. Pretend you are on the escarpment of the volcanoes, and make up a dance. Make up a dance in a small room with no windows. Are there differences in the dances in each of these places? If so, what kind of differences? What different feelings do you have in each place?
10. Police artists draw composite pictures of unknown offenders based on verbal descriptions of their physical appearance by eyewitnesses. "Draw" a word picture of the "inner appearance" of people who vandalize or deface property; or people who litter.
    - What are the main differences in the factors which might cause people to vandalize or deface property, and those which might be associated with littering?
    - Which of the two types of behavior problems might respond more readily to re-education and rehabilitation? Why?
11. Devise games to explore different methods and levels of communication within a class.
    - How skilled are the members of the class at reading each others' body language?
    - What happens if everyone in the class is seated back to back for a few days?

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*"ME Chart" idea adapted from *Decisionmaking*, by Clyde and Barbara Dodder.

- How successfully could class be conducted without any use of the spoken or written word for a day?
- How adept are students at explaining each others' behavior?

12. Display color cards (red, green, yellow, blue, etc.) in different parts of the room. Ask students to go to the color with which they identify.
    - How many students think they would usually select the same color? How many think they selected it because of their present mood? What other colors might they choose at different times? What would be the difference in their moods?
    - Can they "color" their energy, and move in accordance with the color they select?
    - How does your energy flow if you color it yellow? Green? Red?
    - How do the different colors associated with Albuquerque's natural environment affect the students' moods? How do they feel about the green of neighborhood parks? The brown of the mesas? The watermelon color of the Sandias at sunset?
13. Select personal spots—"privacy areas"—in the schoolyard or in a nearby park. Sit quietly and alone in this spot after lunch. Look at the sky, the ground, the mountains, the volcanoes, or the trees. Or, just close your eyes and meditate. If you feel like it, make a drawing to express your thoughts and feelings, or write an entry into a real or imaginary diary.
    - How would you feel about sharing your spot with one other person? Two people? Many people?
14. Prepare two signs like those below, and display them in the room. Discuss them, create role-playing situations, or make up a puppet story to help discover their full meaning.

    To the other guy,
    you're the other guy

    "Cada cabezo
    es mundo"

    - How do these signs help us understand why we sometimes have trouble making other people understand us?
    - How do these signs help us understand why there are so many different opinions about the way a community functions, and why it takes so long for decisions to be made?
15. After some unusual happening in the school, ask children to tell in detail what occurred and to interpret it.
    - Are there discrepancies in the facts as presented by the children?
    - Are there different interpretations of what happened? Are there different explanations for why the happening occurred?
    - Is there a "right" and a "wrong" to the factual reporting? To the interpretations? To the explanations? Why?
    - What influences how people interpret what they have observed? What influences how they explain the reason for an occurrence?
    - Can these differences among people help us understand why people act differently from each other? Why they make different decisions?
16. Write a brief autobiography.

EYE-OPENER WORKSHEET 9: HOW WELL DO YOU TREAT YOUR INNER ENVIRONMENT?

- Keep a list of the food you eat in one day. Next to each item, record the number of calories that food provided. What was your total caloric intake for the day? ______________

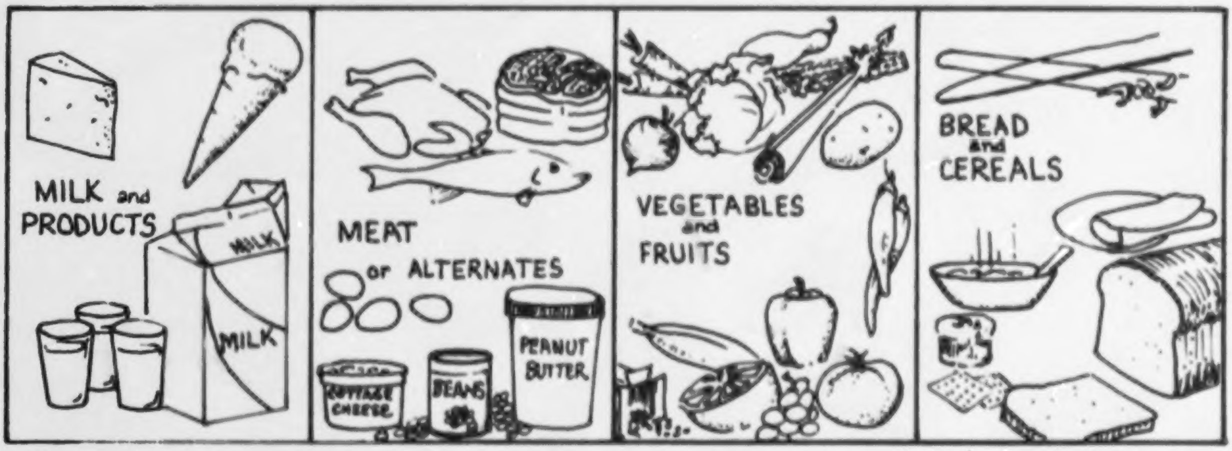
Breakfast		*Lunch*		*Dinner*		*Snacks*	
Food	Calories	Food	Calories	Food	Calories	Food	Calories
Total ______________		Total ______________		Total ______________		Total ______________	

Make a circle graph to illustrate the percentage of calories eaten at breakfast, lunch, dinner, and as snacks.

- Compare your diet for the one day to the following diet recommended to give young people the nourishment they need for growth and good health. Circle all the foods you ate that day.

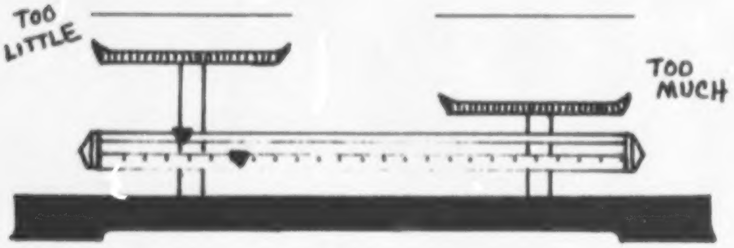
THE FOUR FOOD GROUPS

Every day you need ...


MILK and PRODUCTS
MILK
MILK
MEAT or ALTERNATES
COTTAGE CHEESE
BEANS
PEANUT BUTTER
VEGETABLES and FRUITS
BREAD and CEREALS

3 or more servings | 2 or more servings | 4 or more servings | 4 or more servings

Write the names of the foods for which your consumption was *more* than necessary; *less* than suggested. Use the illustrated chart.



- Which of the foods you ate could be considered "empty" calories (very little food value)? ______ ______ ______ ______ ______ ______ ______ ______ ______ Add up the number of "empty" calories you ate during the day. ______ What percentage of your total caloric intake is that? ______%

- What is meant by "junk food?" ______
Do you think most people know which foods are considered "junk foods?" ______ Do you? ______ What are some reasons you think people eat "junk food?" ______

- Are you giving your "inner environment" the "break" it deserves? ______ If not, what should you add to your diet? ______ ______ ______ ______ ______ ______ ______ What should you take away? ______ ______ ______

17. Take a trip to a supermarket, or bring to school a variety of cans, jars, and packages of food. Read labels to find out what ingredients they contain.
    - Approximately what percentage of the cans, jars, and packages examined contained some food additives?
    - Which additives were found most often?
    - Why are additives used?
    - What objections are raised to the use of additives in foods? What information can be found to support or refute these objections?
18. Watch children's television programs for three or four days. Keep a record of the breakfast cereals which sponsor them.
    - How long is each commercial? How many commercials are shown on one program?
    - What methods do the commercials use to sell their products? Are any of the commercials misleading in the way they present their products? If so, how?
    - Read the labels of the cereals which sponsor these programs. How many of them have high nutritional value? How many of them have large concentrations of sugar? How many have artificial coloring or flavoring? Other additives?
    - How many children in the class eat any of the cereals advertised? Why do they eat them?
19. Conduct a "Snack A-B-C's." On successive days, have children bring in snacks which begin with different letters of the alphabet: Monday—apples, apricots, angel cake; Tuesday—Twinkies, Tootsie rolls, tangerines; etc.
    - Which of these snacks are nourishing as well as tasty to eat? Which can be considered "empty calories?"
    - What kinds of good-tasting and nutritious snacks can the class make in school? (See *Diet for a Small Planet* for recipes.)
20. Consult a health education book to find out what the different food nutrients do for the body. Prepare a chart similar to the one below:

Nutrient	*How the Body Used the Nutrient*	*Important Sources*
Protein	growth repair of tissues	meat fish soybeans
Fats		

    - Do any of the foods in the third column come from outside the United States? Explain.
    - Name any locally-grown foods which are important sources of nutrients.
    - What are the advantages of eating locally-grown foods?
    - Are any of the foods in the third column especially popular with the class? Especially unpopular? Why?
21. Use the Yellow Pages of the Albuquerque phonebook and the local newspaper to determine the number of eating places there are in town. Cut out restaurant advertisements. Make a color key of the different nationalities represented by the restaurants and their specialties. Fashion a collage of the ads on brown paper.
    - What percentage of the eating places are fast-food restaurants?
    - How many health food restaurants are there? What kinds of foods are served at a health food restaurant? How many students have ever eaten in one? Which of the foods did they like? Which did they not like?
    - Tally the number of restaurants of different nationalities or ethnic groups: French, Mexican, Indian, Chinese, etc. Show results with bar graphs. Which types of food do the students like best?
22. Examine the sample daily diets prepared by the class to see how much of our protein comes from meat. Compare our eating habits with those of people in the densely populated, developing nations.
    - What does the phrase, "eating high on the **food pyramid**" mean? Do people in the over-populated, developing nations eat high on the food pyramid? Why? Do we? Why?

- How much energy is lost at each level of the food chain? (About 10 percent) What are some of the ways energy is lost in the food chain?
- Using the 10 percent rule, how many kilograms of beef would be necessary to produce one kilogram of human protein? How many kilograms of corn would be needed to give 10 kilograms of beef?
- What is the recommended ratio of grazing livestock per acre in the rangeland outside of Albuquerque? What happens when land is overgrazed? To what extent has this happened around Albuquerque? How could the same land be used to provide more food?
- What foods could we eat "lower on the food pyramid" and still derive the protein we need? Which of these foods do the students like? Which foods do they dislike? What are the main reasons for liking or disliking foods? Can people's eating preferences be changed? How?

23. Find out from relatives or from books what sample diets were like for Albuquerque's three major cultures a generation or two ago.
    - What determined the types of foods generally eaten at that time?
    - Were the average diets nutritious and well-balanced? If not, what types of foods were lacking? What types were overused?
    - Were these diets high or low on the food pyramid?
    - How do the foods served in our homes now compare with those of the past? If there are differences, what might explain them? What role does advertising play? The mass media? Closer communication among the different cultures?

24. There are many ways other than poor eating habits which hurt our "inner environments." Noise pollution is one example. Sounds are around us all the time. We become used to them, often not even hearing them. Sit for two minutes with eyes closed, and just listen for sounds. List those heard.
    - Which sounds could be considered *noises?* What is noise? What is excess noise?
    - How is noise measured?
    - How noisy is the school? Try to calculate the decibel level in the cafeteria; at a basketball game; in the school yard at lunchtime.
    - At what point does radio or record-player music become noise?
    - How can high decibel levels harm the body?

25. Trace your body. Put in various parts of the body, including the cardiovascular system, the respiratory system, and the digestive tract. Write labels describing some of the ways we hurt our inner environment. Draw arrows from the labels to the part of the inner environment harmed by the way we and the outer environment treat them. Work in teams of three students. Half of the teams may use resources; half should guess. Compare results.
    - What parts of the inner environment are hurt by pollutants in the air? By smoking? By being near people who are smoking?
    - What parts are hurt by excessive noise?
    - What parts are hurt by junk foods and food additives?

EYE-OPENER WORKSHEET 10: HOW CAN YOU GET SOMETHING DONE?

Students often have ideas about how their school or school grounds could be improved, but they do not know how to insure that these ideas are used.

Several general ways of getting something done are listed below.

A. Do it yourself.

B. Get your classmates to help you make the improvement.

C. Talk with your teacher.

D. Talk with the principal.

E. Ask the Student Council to help.

F. Talk with the Parents Association at school.

G. Take the problem to the School Board.

H. Get in touch with a local environmental group.

I. Contact a municipal or county agency.

J. Write to an elected official.

K. Write an article for the school newspaper.

L. Write a letter to the editor of a local newspaper, or to a TV commentator.

Next to each of the sample improvements students might want, write the letter(s) standing for the method(s) you think would be best for handling the particular problem.

Problem	*Best Method(s) to be Used*
The school grounds are drab and bare. You think they should be landscaped.	
You would like to see your classroom kept clean and litter-free.	
The school playground has no facilities for team sports. You think there should be basketball courts or a soccer field.	
There is a dangerous intersection near school. You want a traffic light.	
You think the school would be more attractive if a large mural were painted on the wall at the front entrance.	
Fire Department regulations prevent using wall hangings and furniture your classmates brought in to beautify the room.	
You think the school should try to make money for some special project by taking part in a recycling project.	

On a separate sheet of paper, draw a flowchart showing the steps involved in handling one of the problems.

26. With your class identify a problem in the class, school, or community. Working in small groups, have the students view the problem as it might be seen by a person with an Indian, Hispanic, Black, or Anglo heritage.

    Bring in (possibly from UNM) persons representing these heritages and ask their help in viewing the world through different eyes. Stress the similarities and differences, and try to find the reasons.

    Make a survey sheet for other students to see if they agree with and identify with cultural behaviors attributed to their heritage, recognizing that within each group there are individual differences.

    - Are people's opinions about community (class, school, or neighborhood) problems more affected by their cultural heritage or by their own personal experiences and thoughts? Is it possible to generalize?
    - Do students from the various cultural backgrounds feel that they are less influenced in their decisionmaking by tradition and heritage than their parents are? Their grandparents? If so, how do they explain this change?
    - Is there such a thing as a "Native American position?" A "Hispanic position?" A "Black position?" An "Anglo position?" Discuss.

27. Select a controversial school topic (litter, crowded parking lots, over-consumption of paper, need for landscaping, noise in the halls). Assign students the roles of all members of the school community concerned with the issue (principal, teachers, students, parents, custodian, neighbors). Set up a mock conference and have each person express his viewpoint about the issue.

    - Why do people in different "niches" have different points of view?
    - Does role-playing help understanding other people's positions?
    - What systems can be devised in the school community to increase communication and understanding of other people's niches, opinions, and rights?

28. If the school is in an older section of town, interview parents and relatives who might have attended the school. Invite them to come to class and participate in a discussion of "Then and Now."

    - What physical changes have occurred in the school building and the school grounds since they went to school?
    - What changes have occurred in the neighborhood?
    - Did the school serve as a community focal point then? Does it now?
    - What recollections do they carry with them of their school days here?

29. Without conducting any research, prepare a chart showing the various people in the school community and the niches they fill, their jobs, and their responsibilities. Set up committees to conduct interviews with these different people after the chart has been prepared. Discuss your findings.

    - How well did the students understand the scope of each or the different niches before they did research? What can we learn from this?
    - How much overlapping is there among the different positions? How complex are the interactions?
    - What kinds of decisions are made within the school? What decisions are dependent on restrictions imposed by the larger community?

30. Use a dictionary to find the definitions of the word *community* in both its biological and human society sense.

    - According to the biological definition, is a tree a community? A rotting log? A piece of moldy bread? If so, what living things can be found in each of these communities? How do they interact?
    - What are some of the communities the students belong to? To show these, use a series of concentric circles.
    - What are some of the ways the people in each of these communities interact with each other?
    - What are some of the non-living conditions (temperature, moisture, water) in the environment of a tree community, a rotting log community, and a piece of moldy bread which affect the living things present?
    - Do these biological communities affect the nonliving conditions around them? If so, how?
    - What are some of the nonliving conditions in the environment of human communities which affect people?
    - Do human communities affect the nonliving things around them? If so, how?

Section IV

ALBUQUERQUE TODAY AND TOMORROW

INTRODUCTION

Natural and human ecosystems can be studied as separate entities, as they have been previously in this book, only for the sake of convenience. The realities of a society as large and complex as Albuquerque in the last quarter of the twentieth century prevent any one system from existing in isolation from the total environment. Changes in the natural world affect the human community; conversely, changes in human society lead inevitably to modifications in the natural systems. This section deals with the dynamic encounters of human and natural systems which have been developing and occuring in the Albuquerque area. It deals also, with the role planning has served as a link between Albuquerque's present and future.

Not all of the Albuquerque Public Schools are within the area covered by the Albuquerque/Bernalillo County Comprehensive Plan. However, the concepts and concerns of the Plan relate to other jurisdictions as well.

ALBUQUERQUE'S COMPREHENSIVE PLAN

The Comprehensive Plan for the Albuquerque area was developed through joint efforts of many individuals and groups working with city and county staff. It emphasizes the foundation of policies and objectives from which detailed plans for the various sectors of the urban area can be developed. The Plan concentrates on three major programs:

1. Defining of urban form
2. Timing of development
3. Urban conservation

Thus, planning, as outlined in the Comprehensive Plan, is one method by which satisfactory trade-offs between environmental and economic needs can be achieved.

PLANNING AND THE PEOPLE OF ALBUQUERQUE

Any plan must be understood and supported by a major segment of the community in order to ensure that it is effectively implemented.

Why Albuquerque? All of us, as citizens of Albuquerque, like certain things about this city and dislike other things. Obviously, there are more things we like about it than we dislike, or we wouldn't be here. What are these features of Albuquerque we like which we want to retain? Conversely, what are the aspects of the city we dislike which we would like to change for the future? The people who live in Albuquerque have a large impact on what our city will be like in the future. Every day, decisions are made which will affect our future. If we act, we can influence those decisions and change the directions in which Albuquerque is going, ensuring that the city becomes what we want it to be.

Why Plan? We have made some mistakes in the past. To avoid repeating those mistakes, we attempt to analyze what went wrong and figure out a better way to do things. For example, we have had floods in Albuquerque. When we analyze what went wrong, we may find out that an arroyo was filled in with dirt and houses were built on top. When the next heavy rain arrived, the water could no longer flow in the arroyo, so it flooded the houses. We learn that in the future, we should plan for the storm water to be carried off either in the original arroyo or in a specially constructed channel. To plan is to say what we want to become. It means assessing where we are, deciding what our goals are, and trying to implement those ideas.

For Whom? Most of us have opinions about what is wrong with Albuquerque. As we all know, it is easy to criticize, but not so easy to find ways to solve the problems. Part of a city planner's job is to outline the various alternative solutions. And then, it is the responsibility of citizens to study the alternatives, make choices, and impress these choices upon city or county officials. We all need to get involved in making the decisions which affect the future of our city. City and county officials need to know what we think, so that their actions can reflect those ideas.

Who Decides? Final decisions about most policy issues are made by the City Council or County Commission. The Mayor or County Manager is also involved in policy decisions, and runs the administrative part of city or county business. The Environmental Planning Commission or County Planning and Zoning Commission makes decisions in planning matters such as zone changes, and advises the Mayor or County Commission on major issues such as the Comprehensive Plan.

Most of the issues discussed in government have been raised by citizens. Examples of important programs initiated by citizens include the purchase of major open space areas, animal control, and the bikeway system.

How To Decide? What do city or county officials do when there is a difference of opinion? What if one group wants an issue decided one way, and the other group is totally opposed? What factors do officials use to decide? How do we, as individuals, decide how we stand on issues?

After several years of experience with comprehensive planning, the City and County believe more firmly than ever that the key to success in this effort is active community participation at every stage.

EFFECTS OF THE COMPREHENSIVE PLAN

The initial three elements of the Comprehensive Plan: the *Policies Plan, Metropolitan Areas and Urban Centers Plan,* and the *Plan for Major Open Space* have had a basic, positive effect in shaping the future of the community. The *Policies Plan* consists of goals and policies which serve as general guidelines for land use and environmental decisions. Possible techniques for implementing the policies are also included. The *Metropolitan Areas and Urban Centers Plan* delineates five metropolitan areas which vary in population density and general character. The areas range from urban centers, where the most intensive infill development is to occur, to rural and open areas where lower densities are maintained. The *Plan for Major Open Space* designates a regional network of open space to be acquired by the public or preserved by other means.

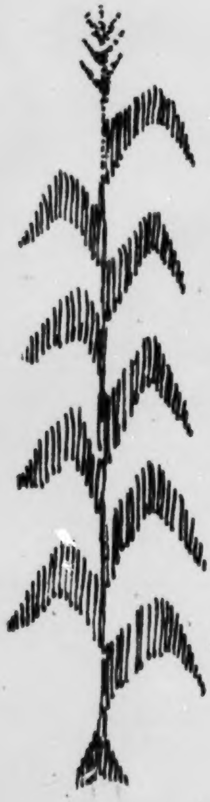
The *Plan for Housing and Neighborhood Assistance* (PHNA), is the fourth element of the Comprehensive Plan. It is designed to bring together all the City's programs for housing and neighborhood facilities into a comprehensive, coordinated strategy to improve Albuquerque's neighborhoods and avoid urban obsolescence. The PHNA focuses exclusively on the city as it exists.

The first and most important result of the Comprehensive Plan is DEFINITION OF THE URBAN FORM. That is, the Plan appears to have successfully delineated the location and character of such major features of the metropolitan area as open space and the urban centers; key implementing ordinances have also defined the geographic limits to development which will protect the natural setting of our community.

The Plan has had a more limited effect on the MANAGEMENT OF URBAN GROWTH. However, as the city continues to grow, the policy decisions involved in preventing urban sprawl and providing municipal services become pivotal in determining Albuquerque's future.

The third effect of the Plan is URBAN CONSERVATION. Urban conservation is a term coined by planners to describe the study of recycling of cities. The concept is based on an understanding that we can no longer afford the luxury of throwaway cities and that coping with urban obsolescence will surely be one of the major problems of our community in the future. The PHNA mentioned above is the first URBAN CONSERVATION element of the Comprehensive Plan, and establishes the overall framework for smaller scale area and neighborhood plans.

It is clear that the Comprehensive Plan is a workable tool with potential for shaping the future of the Albuquerque Metropolitan Area.



SUGGESTED INFUSABLE AREAS OF THE CURRICULUM

Grade	*Subject Area*	*Topic*	*Activities*
K-12	Art	Explore and use found materials to produce environmental design; acquire understanding of how societies shape their environments; know and design aesthetic components into the civic, industrial, commercial, and residential components of the environment; explore and preserve environments having special qualities of ethnic, historical, and/or aesthetic qualities; explore and describe the socio-cultural character in ethnic-geographic variations of environments; know and describe the historical evolutions and types of architecture; know how to preserve and make plans to develop it aesthetically	17, 18, 20, 23, 29, 47, 53
K-1	Social Studies	*Small Group Living:* family life in New Mexico; beauty	24, 42, 50, 51
1	Science	*Organisms:* observing organisms and where they live	10, 26, 34
2	Social Studies	City of Albuquerque: beauty; architecture; location of city's functional parts	16, 17, 21, 24, 25, 29, 31, 35, 47, 50–53
	Science	*Life Cycles:* biotic potential; experiments with plants	26
3	Social Studies	*Comparative Study of Cultures:* homes; architecture	16, 20, 21, 29, 31, 47
	Science	*Populations*	34, 39
4	Social Studies	*Southwest Region:* the manner in which people live is affected by the land, while their manner of making a living affects the land	5, 6, 39, 42, 45, 49, 59
5	Social Studies	*Geography of New Mexico and the Southwest:* location of specific landforms	9, 28, 32, 34, 54
6	Social Studies	*Governments:* city government *Growth of Technology:* current land use; current lifestyles	1–7, 11–23, 27, 28, 30–37, 42–49, 53–59
		Roots: "What are the physical characteristics of New Mexico?"; "How do people of New Mexico live today?"; "What are the implications for the future?"	9, 10, 13–16, 28, 30–34, 38, 39, 46, 47, 54, 56–59
	Science	*Middle School Science Curriculum* II. 2. b. Take it or Leaf it III. 5. g. Greenhouse Effect 7. a. Air Quality 7. b. Sick Air 7. c. Secki Dish and the Murky Barrel Caper 7. d. Purification of Water 7. e. Garbage 7. g. The Undesirables 7. h. What is Thermal Inversion? 7. k. Let's Get One Thing Perfectly Clear IV. 1. b. It's a Scorcher 2. f. Erosion of Rocks from Water Action VI. 1. a. Technology in Your City	1–3, 19, 20, 39, 41–43, 45, 50, 51, 54, 55
7	Social Studies	*History of Geography:* analysis of landscape	28, 32, 34, 46, 47, 54, 55
HS	Social Studies	*Geography:* study of the earth and the interaction of people with the earth	18–20, 28, 32–34, 39, 45, 46, 54–56, 58, 59

	American History: problems of an affluent society	1–7, 23, 31–34, 38–45, 48–53, 56, 59
	Sociology: social organization; social change; social problems	4, 5, 15, 17, 27, 28, 30, 31, 33, 38–41, 44, 45, 48, 49, 52, 53, 58
	Economics: how the American economy operates	5, 15, 17, 21, 22, 27, 30, 41, 46, 49, 52, 53, 57, 58
	Government: structure of local government	6, 7, 14, 22, 23, 31–35, 37, 40, 41, 45, 48, 49, 52, 53, 58
	Anthropology: cultural anthropology principles that govern peoples actions	20, 23, 28, 41, 46, 51, 59
	The City: problems of contemporary urban areas; basics of city planning; future meaning of urban areas	5–9, 12, 14, 15–17, 20–25, 27–41, 45–49, 53–59
	You and the Law: encouraging students to participate in and contribute to their society and its systems of government	6, 14, 22, 23, 31–34, 36, 41, 45, 48, 49, 52, 53
Science	*Earth Science:* reading maps; causes and results of weathering and erosion	34, 54, 55
	Chemistry in the Home: water	34, 54–59
	Environmental Science: water conservation; air pollution; solid waste pollution; overpopulation; energy alternatives	19–22, 34, 38, 39, 42–45, 50, 51, 54–59

RESOURCES

Albuquerque/Bernalillo County Planning Department. *Comprehensive Plan-Three Elements: Metropolitan Areas and Urban Centers Plan; Plan for Major Open Space; Policies Plan.* Albuquerque, NM; 1975.

Albuquerque National Bank. *New Mexico Progress.* P.O. Box 1344, Albuquerque, NM, 87103 (free).

Robbins, Cathy. "Neighborhoods," *Albuquerque News,* Nov. 23, 1977–Jan. 4, 1978.

EYE-OPENER WORKSHEET 11: ALBUQUERQUE'S ENVIRONMENTAL CONCERNS

The list below is a catalog of world-wide environmental issues, problems, and concerns. Some of these pertain directly to Albuquerque, while some do not. Some would not have been considered problems ten years ago, but might be ten years from now. Next to each item, place a check in the column you think is appropriate.

	Application to Albuquerque				
Area of Concern	Major Concern	Growing Concern	Minor Concern	Not Applicable	No Opinion
Chemical, Biological, and Radiological Contamination:					
Agricultural chemicals					
Pesticides, fungicides, herbicides, insecticides					
Metal poisoning					
Detergents					
Plant and animal diseases					
Pests					
Mine tailings					
Radiation (microwave, et al.)					
Consumerism:					
Packaging					
Advertising					
Product durability					
Consumer information					
Impulse buying					
Status products					
Economic/Social/Cultural Environments:					
Lifestyle					
Housing					
Jobs					
Poverty					
Trade balances—comparative advantages					
Civic responsibility					
Cultural identity—assimilation					
Communications					
Energy:					
Power generation					
Fuel supplies					
International trade policies					
New systems and concepts (geothermal, solar, nuclear)					

	Application to Albuquerque				
Area of Concern	Major Concern	Growing Concern	Minor Concern	Not Applicable	No Opinion
Environmental Planning and Design:					
(See also Land Use and Pollution: Visual/Aesthetic.)					
Health:					
Pollution					
Food additives					
Drugs					
Stress (congestion, population density, competitiveness)					
Land Use:					
Reclamation/flood control					
Construction					
Strip mining/erosion					
Planning					
Recreation					
Open space/scenic and historic preservation					
Real estate					
Urban renewal					
Natural Environments:					
Habitats					
Endangered species					
Communities/ecosystems					
Survival					
Pollution:					
Air					
Particulates					
Engine emission					
Incineration					
Industrial effluent					
Smog					
Water					
Flood control					
Sedimentation					
Thermal discharges					
Soft and Solid Waste (See also *Solid Waste*.)					
Agricultural runoff					
Municipal sewage systems					
Limnology					

	Application to Albuquerque				
Area of Concern	Major Concern	Growing Concern	Minor Concern	Not Applicable	No Opinion
Noise					
Traffic					
Construction					
Industrial					
Visual/Aesthetic					
Signs and billboards					
Construction design					
Transmission lines					
Landscape architecture					
Graffiti					
Population:					
Distribution and density					
Growth rate					
Migration					
Mobility					
and food supply					
and resources					
Resources:					
Recycling					
Renewable					
Soil					
Water					
Forests					
Fishery and wildlife management					
Nonrenewable					
Minerals					
Fossil fuels (See also *Energy*)					
Solid Waste:					
Recycling					
Recovery					
Disposal methods					
Source reduction (packaging)					
Transportation:					
Mass transit					
Motor vehicles and highways					
Aircraft and airports					
Safety					
Traffic congestion					
New systems and concepts					
Mobility					

Collate the responses to any 10 of these Areas of Concern selected by the class. Present this information in the format of an "Opinionaire."

Example: Questioned about the importance of the issue ______________________________
to Albuquerqueans, students in ______________________________ responded as follows:

Major Concern .... ____%
Of Growing Concern .... ____%
Minor Concern .... ____%
Not Applicable .... ____%
No Opinion .... ____%

Discuss student reactions to these findings.

For two weeks, keep a clipping file of all Albuquerque newspaper articles related to environmental issues, problems, and concerns. Count them as votes for the significance of various Areas of Concern above. According to the newspaper articles, what are Albuquerque's major environmental concerns at this time?

________________ ________________ ________________ ________________

________________ ________________ ________________ ________________

________________ ________________ ________________ ________________

Discuss the results of this media tabulation in comparison with your own assessment of the most important concerns.

ALBUQUERQUE ENVIRONMENTAL TOPIC 1:

*AUTOMOBILES, BUSES, AND TRANSPORTATION FUNDS**

Background and Problems

Albuquerque's sprawl has made it a city dependent on the automobile for transportation. During the 1970's, Albuquerque's population increased by 100,000. Its geographical size increased by eight square miles (21 km^2). Vehicle miles traveled (VMT) have been going up at the rate of 10 percent per year (compounded). The VMT in 1970 were 3.9 million; in 1977 they were 6.7 million.

A significant portion of our local, state, and federal taxes goes for construction of roads and highways. It has recently become clear, however, that using the family car as the major mode of travel in Albuquerque must be seriously questioned. Automobiles are known to be the largest source of air pollution in the city. In 1978, the Environmental Protection Agency (EPA) warned that federal highway funds and air pollution control grants would be withheld if the city did not come up with a plan to reduce air pollution in Bernalillo County by January, 1979. In addition to dangerous emissions resulting from the growing use of the automobile, such problems as mounting urban congestion, human and economic suffering as a result of accidents, and the huge consumption of petroleum products necessitate immediate attention. Many people have started to give serious thought to development of alternatives to the family car as a primary means of transportation.

- Should we spend a larger percentage of our tax money on development of facilities for alternative sources of transportation?
- What forms of mass transportation would best serve the needs of the people of Albuquerque?
- How can people be made aware of the problems associated with overuse of the family car? How can they be encouraged to change their transportation habits?

Opinions/Options/Possible Solutions

- A high priority should be given to funding an improved public transportation system.
- Cars are the most convenient form of transportation, and people do not want to cut back on their use, so we should build new roads to relieve congestion.
- We should improve and maintain existing roads, but not build new ones.
- Mandatory emissions inspections and controls for all automobiles are essential.
- We should build more roads *and* develop facilities for improved public transportation.

Activities

1. At a traffic light on a main arterial at rush hour, count the number of cars with only a driver. How many cars could one bus replace? Find out what the predominant automobile air pollution emissions are. How much carbon monoxide does an average bus emit? How much does an average automobile? What factors influence this figure? How would the per capita carbon monoxide emission of a filled bus and a one passenger car idling at a red light compare?
2. Contact the City or County Environmental Health Department for information about carbon monoxide levels at various times during the same 24-hour period. Using weather information for that period, do a vector analysis to track the movement of the polluted air from its source to other parts of the city.
3. Find out from the Environmental Health Department which parts of the city usually have the highest carbon monoxide levels. Obtain a Traffic Flow Chart. Compare the information derived from both sources. What is the major source of carbon monoxide pollution in the city?
4. Prepare a questionnaire to determine attitudes concerning automobile use versus public transportation for adults and for teenagers. Distribute this questionnaire to a statistically selected sampling of students, parents, and teachers. Discuss findings. Prepare a summary to be shared with the school population and with the entire community.
5. Set up a chart to show the impact of the automobile on us as individuals and on society. Consider cost of purchase and operational costs; all automobile-related taxes; land use effects; all effects on health, including accidents and air pollution; noise; congestion; and psychological effects on the community. Is a non-polluting car a sufficient solution to the problem of overuse of the automobile?
6. Find out if a transportation corridor is currently under consideration for development or improvement. Have the class do research to prepare its own Environmental Impact Statement concerning this corridor. Compare their statement with the one prepared by public agencies. Find out in what ways the public is involved in decisions about the corridor.
7. Devise alternative transportation plans for the Albuquerque metropolitan area. Consider such approaches as: rearranged traffic flow patterns; new approaches to our present bus system; innovative forms of mass transportation; increased use of bicycles. Present promising plans to the the governmental entity responsible for transportation in your area.

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*See also p. 5.

ALBUQUERQUE ENVIRONMENTAL TOPIC 2:

DOGS

Background and Problems

It has been stated that the problems most complained about by city residents across the country pertain to dogs. Noise, unsanitary conditions, attacks on people, roaming packs of wild dogs, owners who allow their pets to run in parks or on other people's property, dogs getting into garbage containers are problems associated with dogs in Albuquerque, as well as in other cities. The effect of dogs is felt in the foothills and mountains, too. They are considered responsible to a large extent for diminishing mule deer populations, and they are a recognized threat to domesticated sheep.

- What role can the city and county play in assuring that the rights of dog owners and the community are both served?
- What can be done to prevent an increase in the population of wild dogs?

Opinions/Options/Possible Solutions

- People enjoy pets and need dogs for protection. In a cost/benefit analysis sense, the advantages of dogs in the city outweigh the disadvantages. Complaints are primarily from "cranks."
- Existing leash laws should be enforced against all dog owners, including those whose dogs wander loose in parks or in the foothills.
- Dogs found wandering loose should be impounded and destroyed.
- Owners of dogs considered a nuisance by neighbors should be forced to get rid of the dogs.
- A law should be passed stating that all dogs will be neutered except those for whom a breeding permit is purchased.

Activities

8. Contact the Animal Control Center for an approximation of the number of feral (stray) dogs in the city. (The 1978 estimate was 60,000-70,000.) Assuming that most of these animals have not been neutered, that half of them are female, that each female goes into season twice a year, and that the average number of pups surviving to adulthood is 4 per litter, calculate the size of the feral dog population at the end of one year. At the end of five years.
9. Do research on the types and extent of damage done by feral dogs in the foothills and in the mountains. Contact the Forest Service or Department of Game and Fish for information. What steps are public agencies taking to control these dogs? How successful are they? What other measures can your class recommend?
10. Some owners of unneutered female dogs dispose of puppies by driving them to a remote spot and turning them out of the car. Write a short story about the experiences of such a pup.
11. Conduct a survey in your class, grade, school, and/or neighborhood to determine how many people have unneutered dogs (female and male). Try to ascertain why they have not been neutered, and what incentives (positive or negative) could persuade the owners to take this step. Find out from the Animal Control Agency whether the small fee for permanent pet registration for neutered animals which was started in 1978 in the city has been a successful incentive. What other incentives can your class suggest?
12. Design posters to be displayed in neighborhood shopping areas to promote neutering.
13. Conduct a debate on the subject of the communities right to pass and enforce laws concerning leashing and neutering of dogs.
14. Make up a new animal control ordinance for the City or County.

ALBUQUERQUE ENVIRONMENTAL TOPIC 3:

DOWNTOWN DEVELOPMENT

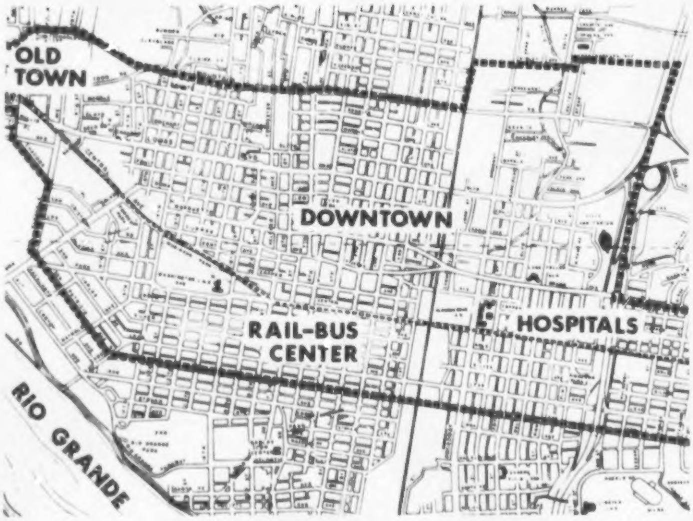
Background and Problems

Albuquerque, like many other American cities, has set revitalization of the Downtown Area as an important goal. At present, Downtown Albuquerque is "alive" from 8 a.m. to 4:30 p.m. closing up figuratively, and almost literally, when federal, state, county, and city workers, and employees of large business firms, leave for home. The expression of the identity of our city, the creation of cultural and entertainment centers, and the encouragement of economic activity through tourism and conventions are objectives which many think can be achieved by redevelopment of Downtown areas.

- Could changes in the Downtown shopping areas make it competitive with newer retail areas in the suburbs?
- What architectural style(s) would serve the objectives of a revitalized Downtown best?
- How can land be used most effectively to achieve the multi-functional Downtown envisaged?
- What kinds of residential buildings should be constructed?
- What could be done to avoid having Downtown dominated by the automobile and services associated with it?
- How should Downtown development be financed?

Opinions/Options/Possible Solutions

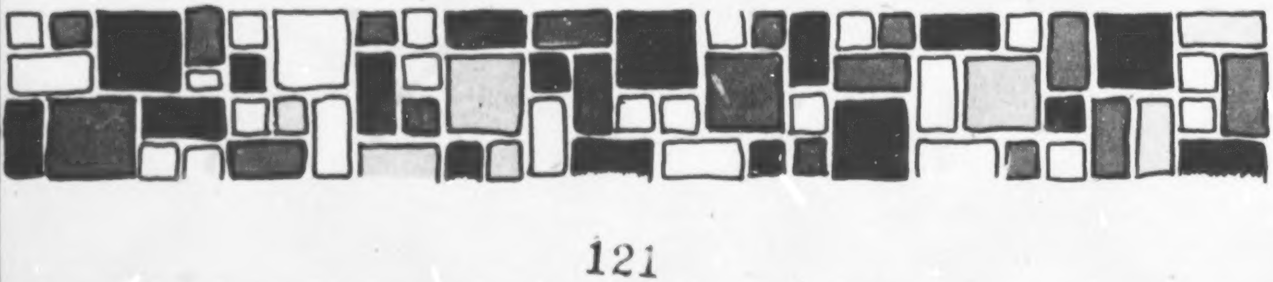
- Large scale urban renewal projects should be financed primarily by the federal government.
- Small scale programs, such as historic preservation or locally financed loans to businessmen and developers, should be encouraged and increased.
- Incentives should be provided for multi-modal transportation systems, housing developments, and cultural activities to locate in Downtown, thereby encouraging multiple uses, and not just business offices and retail stores.
- All efforts to revitalize Downtown should receive the full support of the community.



Activities

15. Set up a two-column chart. In the first column, list the ways students think Downtown Albuquerque is used at present (public agencies, large businesses). In the second column, list ways students think Downtown could and should be used. Evaluate the suggestions, and discuss the steps needed to bring them about.
16. Take a walking trip through the Downtown Area and note architectural features. What types of architecture appeal to each student? Are there any universals of good design? What kind(s) of architecture best express Albuquerque's traditional identity? Which of the old buildings should be saved and restored? Why is the KiMo Theater being preserved? Find out about Art Deco, the art form used in the KiMo's interior and exterior designs. Discuss reactions to it as an art form. Use it as a basis for students' designs.
17. Have students think about how they might go about developing their own Downtown Revitalization Plan. Develop a three dimensional model of parts of the area, including possible changes. Consider such points as architectural style, placement of cultural centers, retail stores, residences, office buildings, traffic flow, pedestrian malls, innovative public transportation methods, and amenities such as parks, outdoor restaurants, landscaping.

Mosaics from KiMO BUILDING
Oreste Bachechi 1927



ALBUQUERQUE ENVIRONMENTAL TOPIC 4:

*FUTURE BUILDING DESIGN**

Background and Problems

In an attempt to consider our cultural heritage, energy conservation, and new legal opinions concerning access to sunlight, water, and wind—traditional standards for building design are being reevaluated.

- Should old buildings with historic value be preserved, even though it costs as much or more to renovate them as it does to construct a new building?
- Should solar and wind access for old buildings be preserved at the cost of an adjacent high rise office or apartment building which might have a high tax base?
- How can the land-use and energy-savings features of cluster developments and multiple dwelling units be achieved without sacrificing the psychological benefits of privacy or direct access to the outdoors which is provided by the traditional, large plot, single family home?
- What are the advantages and disadvantages of windowless buildings and shopping centers with climate control? Should building codes reflect these factors?

Opinions/Options/Possible Solutions

- Since traditional methods have worked in the past, they will continue to work in the future.
- Economic factors should determine whether or not building codes should be modified.
- Historic and cultural factors should override other considerations in determining whether a building should be preserved.
- Traditional standards for construction should be expanded to include the right to access to non-traditional energy sources.
- Building codes must contain mandated provisions for energy conservation.

Activities

18. On a sunny day, compare the midday temperature of a room (windows closed) on the south side of a building with that of a room on the north side. If there is a difference, what explains it? What is "the greenhouse effect?" How can the **greenhouse effect** be used as part of a passive solar energy system?
19. Set up experiments to learn about the reflective, absorptive, and retentive qualities of different materials and colors. Use these results to design solar collectors effective enough to heat water. Work in competitive teams to try to develop a collector which produces the greatest change in water temperature in a gallon of water in 1 to 1½ hours. How can these principles be applied to building design?
20. Design a "House for the Future." Try to plan the house to be as self-sufficient as possible on an average-size lot. Consider availability of materials, energy problems, future lifestyles, and the relationship of the architecture to Albuquerque's natural environment and to the city's cultural history. Is it possible to build such a house within the city limits? County limits? What laws exist to allow this to happen? What are the avenues for change?
21. Have each of three groups select what each consider an aesthetically-pleasing, architecturally-pleasing, or energy-conserving building. Defend choices after research on origin, plans, existing laws met when building was constructed, and cost/square feet when built and now. Compare with a building they feel does not meet these standards in terms of costs, durability, beauty, and energy conservation. Draw conclusions for consideration.
22. Do research to find out what factors are included in our present building codes. Are there any energy conservation regulations? If not, discuss whether there should be. What process would have to be followed to have these regulations added to the code? Have students present their opinions to city government.
23. Assume a hypothetical situation in which a developer owns a lot zoned for six single-family residences. Prepare sketches to show: (a) the conventional way of subdividing the property; (b) cluster development using unattached houses; (c) townhouses. How would zoning ordinances affect the plans for (b) and (c)? What are the advantages of each of the three arrangements? Disadvantages? Find out if any subdivisions are being considered in the neighborhood of the school. Have the class discuss the development design they think this property should have.

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*See also p. 71.

ALBUQUERQUE ENVIRONMENTAL TOPIC 5:

LANDSCAPING OF PUBLIC PLACES

Background and Problems

Landscaping for streets, highways, shopping areas, and public plazas is one important way of beautifying a city. Albuquerque has been showing increasing interest in such programs.

- Should landscaping be a high priority activity for Albuquerque?
- Is the large cost of maintenance worth the benefits?
- Who should pay the installation costs of landscaping? Maintenance costs?
- Should the amount of water required by various types of plants be a factor in determining their selection?

Opinions/Options/Possible Solutions

- In arid natural areas and cities, the relief of green spaces is worth whatever it costs.
- Native vegetation, which usually requires less water than other plants, should be used when appropriate.
- Landscapers should be encouraged to make extensive use of rocks and gravel.
- Landscaping, although it provides many benefits (aesthetically pleasing, noise and visual barriers, shade), is too expensive at this time when the city has so many other needs.
- The method of financing landscaping should be one which does not impose a disproportionate share of the burden on the poor through regressive taxes or higher prices at the marketplace.

Activities

24. Prepare a list based on recollection, or on a class field trip, of places around the city that could be improved by landscaping. Select one area in which the class is especially interested. Contact the City or County Planning Department or Parks and Recreation Department to see if there are plans for landscaping in that section. If there are not, develop class plans. Present them in two- or three-dimensional form to one of the agencies.
25. Contact the City or County Parks and Recreation Department about the "Gifts For Parks Catalog" a program which encourages private contributors to pay for landscaping and equipment to improve the quality of public centers. Conduct a fund-raising event and purchase a shrub, tree, or planter to be donated to a site selected by the class.

CHAMISA
(RABBIT BRUSH)

26. Set up a controlled experiment in the classroom to determine the difference in amount of water required by cacti and other succulents as compared with such house plants as ivy, philodendrons, and begonias. If the school grounds have both native vegetation and non-indigenous plants, find out from the custodian whether there is a difference in the amount of water used for each type of landscaping. Discuss the "trade-offs" related to the use of each type of vegetation.
27. Prepare a cost/benefit analysis for a hypothetical situation in which trees and planters would beautify one of the major arterials such as Lomas Boulevard, Central Avenue, or Menaul Boulevard. Include in this analysis such points as the cost of installation, labor for maintenance, and water; the benefits such as aesthetic improvement, noise barriers, and shade. Discuss who should pay each of the costs, private business or the city through taxes. Analyze whether or not the citizen pays in either case. Interview small business owners to determine their feelings about landscaping near their stores.

ALBUQUERQUE ENVIRONMENTAL TOPIC 6:

NEIGHBORHOODS*

Background and Problems

The Comprehensive Plan places heavy emphasis on creating distinctive, smaller communities within the larger metropolitan area. It envisages these diverse neighborhoods as appealing to a wide variety of needs, preferences, and incomes of their constituents. The solution to many urban problems, it is felt, lies in the identification of these neighborhoods in existing areas of the city and the encouragement of neighborhoods in new developments. Self-determination of solutions to problems relating to their area would be part of the function of such neighborhoods.

- Should neighborhoods be defined by self-organization, or should the city serve as a catalyst in determining how many there should be, and where they should be located?
- When neighborhood identity is not clearly established through tradition or because a feeling of community has developed for other reasons, how can neighborhoods be defined?
- What role should the private sector and the Albuquerque Board of Realtors play in neighborhood revitalization?
- What guidelines will be necessary to insure that neighborhoods, in determining their own specific goals, select projects which are compatible with citywide needs and objectives. How can parochialism be avoided?
- What are the ways for neighborhood associations to provide community input?

Opinions/Options/Possible Solutions

- If decisionmaking power is vested in neighborhood associations, the representative form of government will be undermined.
- The City Council, County Commission, Environmental Planning Commission, County Planning and Zoning Commission, and the City/County Planning Department have provided ample opportunity for communities to participate in decisionmaking.
- Highest priority in neighborhood vitalization programs should be given to older communities which lack adequate housing and public services. Improving these areas, and restoring historic buildings can create unique communities close to the central city.
- "Neighborhoods" can counteract the feelings of alienation and isolation which are so often associated with cities.
- Neighborhoods should be allowed to decide all issues which affect them.

Activities

28. Ask students to "map" their own neighborhoods either graphically or verbally. Consider such points as: how the student determined the boundaries of his neighborhood; what public or private facilities help to give a sense of neighborhood to the area; which facilities a neighborhood should have are present, and which are lacking; what, if any, physical features help to define the neighborhood; what commonalities are found in the architecture; what similarities exist in the people of the area; what subjective factors contribute to a feeling of community, or an absence of such a feeling; whether or not there is a neighborhood association, and if there is, what its primary focus is. Discuss students' reactions to their neighborhoods.
29. Take a trip on public bus to Old Town to note how architecture helps to define this neighborhood. Have students sketch architectural details which are part of our Hispanic heritage, and which have contributed to Albuquerque's uniqueness and beauty. Working in committees, find out how the Spanish influence in architecture and design has been carried over into other sections of the city.
30. Read this statement from the Policy Plan element of the Comprehensive Plan:

    > "URBAN AREAS: The goal is a quality urban environment which perpetuates the tradition of identifiable, individualistic communities within the metropolitan area and offers variety and maximum choice in housing, work areas, and life styles."

    Discuss the types of diversity which exist in Albuquerque. How does diversity enrich a community? What conditions in our rapidly growing city might tend to lead toward increased homogeneity? (look-alike housing, look-alike shopping centers.) How can a growing city contribute to increased diversity? (See Jane Jacobs: *The Death and Life of Great American Cities.*)
31. Conduct a study of the neighborhood in which the school is located. Have students determine through observation, or by interviewing neighborhood leaders, what the current problems of that community are. (Need for a park, street improvements, better transportation). Select one problem for further study. Find out what the City's or County's plans are in connection with that problem. Develop a proposal designed to contribute to the solution of the problem. Bring the proposal to the attention of neighborhood leaders, parents, and subsequently, to the appropriate agencies.

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*See also pp. 38–40, 83.

ALBUQUERQUE ENVIRONMENTAL TOPIC 7:

OPEN SPACE*

Background and Problems

It is critically important to have publicly owned open space in and around an urban area in order to provide visual relief from the urban scene, to protect ecologically fragile areas and wildlife habitats, and to provide places for recreational activities. In addition, open space in the Sandias protects important watershed and recharge areas, and provides protection from the hazards of flooding. The Sandia Mountains, the Volcanoes and West Mesa escarpment, and the area along the Rio Grande have been designated by the city and county as land which should be purchased for permanent open space. Many programs compete for funds, however, and open space acquisition may be cut back.

- How important is open space to the residents of a city?
- Are there short-range and/or long-range effects of living in a place with no open vistas or relief from concentrations of buildings, streets and people?
- Where should boundaries for development be set? How should these determinations be made? Who should make them?
- How closely should land use decisions adhere to the Comprehensive Plan for Open Space? How closely have they adhered?

Opinions/Options/Possible Solutions

- Purchasing open space wastes money which could be spent on more important programs.
- The tax revenues from these areas is more valuable than just "views" or "visual relief."
- The existing recreational areas and publicly-owned open spaces are sufficient for our needs.
- Open space is needed, and as much money as possible should be allocated to this program. These sums of money, which might seem large from a short-term viewpoint, are relatively small when viewed over a period of decades or centuries.
- Albuquerque's identity as a city and its tourism value depend on retaining these distinctive major geographical features.

Activities

32. On a map of Metropolitan Albuquerque, use a color coding system to indicate land at the city's perimeter which fell into each of the following categories in 1970: privately owned, publicly owned, and Indian Reservation. Write the Planning Department for a chronology of open space purchases. Set up a series of maps showing how the city has progressed toward its open space objectives, as indicated in the Comprehensive Plan. What remains to be purchased?
33. Find out from the newspapers, the Planning Department, or one of the local environmental organizations whether any parcels of land are currently being considered for purchase. If there are any such, conduct research to determine the issues involved. Include in this research interviews with members of the Planning Department and Planning Commission Study Sessions or Hearings. Set up a role-playing situation in the class. Determine democratically the opinion of the class. Present this opinion to Planning Department, the Open Space Task Force, and the Planning Commission.
34. The Comprehensive Plan's *Policies Plan* states that, "The Sandia foothills where the slope exceeds 10 percent shall be preserved for flood control, recreation, and open space purposes." Conduct research to determine what effect development of land with higher slopes would have on flooding, water recharge, and wildlife habitats. Find out from the State Game and Fish Department whether deer populations have been affected by the development which has already occurred. Ask students to take positions about development above the 10 percent slope line, and to defend their positions.

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*See also pp. 14, 17, 56, 57.

ALBUQUERQUE ENVIRONMENTAL TOPIC 8:

PARKS AND THEIR LOCATION*

Background and Problems

Lack of availability of parks in some neighborhoods is frequently mentioned. When parks are available, complaints are often heard about their use by people who create disturbances.

- Where should parks be located for optimum neighborhood access and use?
- Can parks be located and designed so as to minimize problems? What other steps can be taken to prevent park abuse and disturbances of the neighborhood?
- Does the size of a park affect the way it is used?

Opinions/Options/Possible Solutions

- For residential neighborhoods, build only small, one to three acre parks designed to discourage use by people not living in the neighborhood. (No parking areas, no streets circling park.)
- Locate neighborhood parks centrally in the neighborhood, preferably next to the elementary school, and locate large district parks, which attract bigger crowds, away from residential areas.
- Eliminate neighborhood parks. Build only large district parks, away from neighborhoods.
- Eliminate large parks, such as Roosevelt or San Gabriel, because they can become centers of crime, vandalism, and other disturbances.

Activities

35. Conduct a study of the park closest to the school. Use methods such as surveys, interviews, and questionnaires. Consider such points as: where the park is located; how big the park is; the nature of the neighborhood (single-family dewellings, multiple-family dwellings, mixed residential/commercial); the facilities offered by the park; how the park is utilized; how much use it gets; which facilities are utilized most and least; the general condition of the park; reaction of local property owners to the park; what problems, if any, are associated with the park and how they are dealt with; and how the park could be improved. On the basis of this study, prepare a class recommendation to the City or County Parks and Recreation Department and Parks Advisory Board. Ask for an opportunity to present this recommendation.
36. Divide the city or county map into sections and assign one group of students to study each section. Investigate the character of the area, including the amount of open space. Locate and design at least one park within each section. Consider the following points. What process is involved in establishing a city park? What legal steps are involved? What factors should be taken into consideration in locating a park? What size, facilities, landscaping, and general layout seem suitable for the location selected? Find out how the plans prepared by the class compare with existing city or county park policy and with the present plans of the Parks and Recreation Department for each of the sections.
37. Develop a class position about parks. Present this position to the city or county government. What is the process citizens follow in bringing their opinions to the attention of decisionmakers? What guidelines should citizens keep in mind in preparing opinions and positions to be presented to governing bodies?

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*See also pp. 15, 17, 56.

ALBUQUERQUE ENVIRONMENTAL TOPIC 9:

*POPULATION GROWTH**

Background and Problems

Many cities, especially in the Southwest, are experiencing rapid growth. The traditional American view is that growth equals "progress," and that "bigger is better." This view is now rejected by many people who say that the urban problems of crime, congestion, and high taxes inevitably accompany bigness.

- Is there an optimum size for a city?
- Is there an optimum size for Albuquerque?
- Can a sense of community be retained in a large city?
- Does a city have to be large to attract industries to provide jobs?
- Can a city support facilities such as cultural centers, zoos, and museums, or other urban amenities without a large tax base?
- Is there such a thing as an absolute "carrying capacity" for a city? If so, what would be Albuquerque's limiting factors?

Opinions/Options/Possible Solutions

- It is unnecessary, unfair, and economically unwise to restrict the size of a city. Albuquerque should be allowed and encouraged to grow to its full potential. Decisions should be made according to the American way of free enterprise.
- Albuquerque should decide what its maximum size should be, and pass laws to enforce that limit.
- Growth should be controlled through planning and through ensuring that it takes place in certain geographical areas only. Open space should be provided for, further urban sprawl should be avoided, and growth should not put a severe strain on any existing parts of the city.
- There is no such thing as an optimum size for Albuquerque or any other city.

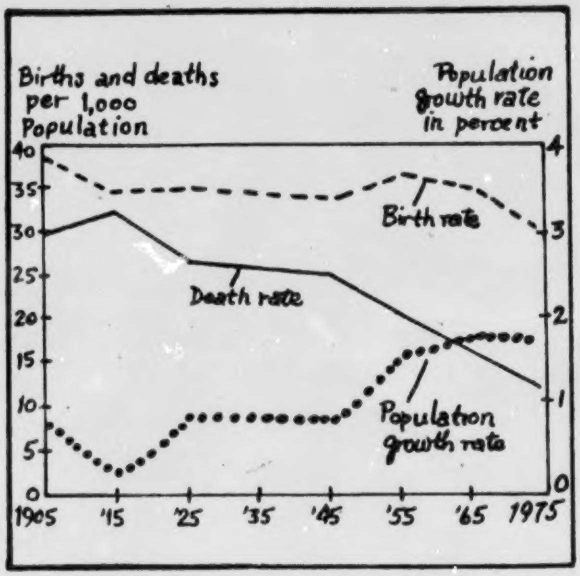
Activities

38. Discuss the differences between linear and exponential growth. How are population growth rates determined? What is Albuquerque's growth rate? How does this figure compare with the national average? How does it compare with densely-populated urban areas? How does it compare with the world's growth rate? In each case, explain.
39. Graph the growth of Albuquerque's population during the past two decades. Predict Albuquerque's population in 2000 AD, based on this graph. Using this prediction, list the demands which will be placed on the community to provide people's needs and wants. How well will Albuquerque be able to meet these demands?
40. Select a Southwestern city such as Denver or Salt Lake City. Don't tell students the name of the city. Make blank maps for the students. List important historical facts about the hypothetical city. Predict what the city would look like with its present population. Investigate water availability, transportation system, and density of population. Compare at some point with the actual city represented and with Albuquerque.
41. Discuss the following quotation from Aristotle:

> "Experience shows that a very populous city can rarely, if ever, be well governed. To the size of states there is a limit, as there is to other things (plants, animals, implements), for none of these retain their natural powers when they are too large or too small."

To what cities was Aristotle referring? What was the fate of these cities? Should the population of a city be controlled? If so, how should its size be determined? Who should make the determination? If the size of cities is restricted, how will the increase in the world's population be accommodated? What are "New Towns," and how are they started? What can be done about the world's population explosion?

*World Birth, Death and Population Growth Rates, 1965–1974**



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*See also pp. 9, 55, 83.

ALBUQUERQUE ENVIRONMENTAL TOPIC 10:

*SOLID WASTE**

Background and Problems

The City of Albuquerque collects solid waste and buries it in sanitary landfills. Because of the availability of landfill sites in this region, the cost of the solid waste disposal system in Albuquerque is far below that of most cities. It has been suggested, however, that many valuable minerals and other resources which could be recovered and recycled are being buried in landfill sites, and that provisions for resource recovery be built into our disposal system.

- What would a resource recovery system cost? Could it be designed to be financially self-sufficient?
- How receptive would the people of Albuquerque be to a mandated resource recovery waste collection system?
- How feasible are other possibilities for disposing of solid waste, such as composting, burning for electric power, and construction of methane plants?
- Have resource recovery programs conducted by Keep America Beautiful, Coors Bottling Company, and Coca Cola Bottling Company been successful? Explain.
- What steps can be taken to combat illegal dumping?

Opinions/Options/Possible Solutions

- Since the present method of solid waste collection and disposal is the cheapest, we should stay with it until one of the other methods can be proven to be more economically advantageous.
- We should be forward-looking and be willing to undertake a **resource recovery** program, even if it is a little more expensive, because of the seriousness of world-wide depletion of natural resources.
- If we move now, future gains, as resource depletion drives up the prices, are likely to outweigh the present incremental cost of a new program.

Activities

42. Keep a record for one week of the composition of an average family's solid waste. Have as many members of the class participate as possible, and calculate an average. What percent of our solid waste is paper and cardboard? Iron and steel? Aluminum? Glass and ceramics? Food scraps and garden waste? Plastic? Rags? Other waste? Calculate the weight of paper thrown out by all the families in the class. Based on this figure, estimate the amount of paper thrown out each week in the city.
43. Do research to find out about the "Use it again, Sam" program introduced by the Environmental Protection Agency (EPA) at its main office in Washington. Do any governmental agencies in Albuquerque have a similar program to salvage office waste? If not, can your class write to some of these agencies to encourage consideration of such a program?
44. Obtain information about the per capita production of solid waste in our country at the present time, and during the past twenty years. Calculate the rate of growth in the per capita production of solid waste. Calculate the exponential growth of solid waste if population growth and waste production continue at the same rate for the next ten years or if the rate of either or both increases. What rates of growth are predicted for each in Albuquerque?
45. Do research to determine what a total, high-technology resource recovery system consists of. Draw a "magic black box" diagram to show the two phases; the "front-end," or material recovery system, and the "back-end," or energy recovery system. Find out whether Albuquerque is considering establishing such a resource recovery system, and whether it is economically feasible. What alternatives, if any, is the city involved in?

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*See also pp. 12, 72.

ALBUQUERQUE ENVIRONMENTAL TOPIC 11:

URBAN CENTERS OR URBAN SPRAWL?*

Background and Problems

Albuquerque is often criticized for "sprawling" in all directions with no limits or sense of planning. Accompanying urban sprawl are the problems of dependence on automobiles with its resultant air pollution and look-alike suburban housing developments. Sprawled development also imposes economic burdens on the city as water lines, sewer lines, and roads are extended far beyond their existing points to accommodate small numbers of new residents. Some housing developments in areas such as floodplains and the high-slope sections of the Sandia foothills have also created problems for new owners and for the city because they are in areas not suitable for building construction.

- Which areas of the city are best suited for urban development? Why?
- Can urban centers, set up as nodes of commercial, cultural, and social activities, help solve problems of urban sprawl? If so, why and how?
- Can higher density housing be mixed compatibly with single-family homes?
- Should present residents of the city or county pay for services and facilities for new housing developments?

Opinions/Options/Possible Solutions

- Continue to use all possible incentives to encourage **infill** development.
- Carefully control development in floodplains and the Sandia foothills.
- Discourage development in outlying areas by limiting the financial role the city or county will play in providing water, sewers, roads, and other services.
- Allow present trends to continue unrestrained.
- Designate "urban centers," and provide public transportation facilities connecting them to the residential sections in their area.
- Maintain strict zoning regulations concerning housing densities.

Activities

46. Discuss what students would have done differently if they could have influenced Albuquerque's growth during the past two or three decades. What mistakes can we now recognize in the city's growth patterns? (Sprawl, location of highways, and shopping centers) Have students build a "New Albuquerque." Use a piece of brown wrapping paper 2′ x 3′. Sketch in the Sandias, the Rio Grande, the West Mesa, and the volcanoes. Ask students to list the components of a city (roads, bridges, dwellings, commercial buildings, shopping centers, railroads, airports, public buildings). Working in committees have students use colored construction paper to cut out the different components. Have each group then place its parts in the places the committee considers appropriate. The problems of constructing a well-planned city soon become apparent.
47. Borrow Jorg Muller's picture collections, "The Changing Countryside" and "The Changing City," from the APS Curriculum Center. Discuss the changes shown in these pictures and relate them to Albuquerque. Prepare a similar set of drawings to illustrate changes involved in Albuquerque's growth.
48. Obtain a copy of the *Metropolitan Areas and Urban Centers Plan* element of the Comprehensive Plan. Based on the map on page 2 of this book, color code a map of Albuquerque to show where each of the Metropolitan Areas and Urban Centers ("redeveloping urban," "established urban") is designated to be. Find out how closely actual development has adhered to the 1975 Plan.
49. Conduct a study to determine the opinions of the community on the subject of "urban centers," as defined in the *Metropolitan Areas and Urban Centers Plan*. Using appropriate sampling techniques, interview people representing each of the following groups: executive of a large retail store in an urban center such as Winrock or Coronado; owner of a small retail store in the same urban center; a security policeman; owner of small retail store *not* in a designated urban center; a traffic engineer; an elderly apartment dweller; a North Valley High School girl; a University student; a homeowner near an urban center; and a realtor. Use these interviews as a basis for a role-playing situation to discuss the question of whether urban centers are beneficial for the city, and can help to prevent urban sprawl. Invite elected officials or members of various agencies to send representatives to present the city's or county's point of view.

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*See also pp. 12, 14, 15.

ALBUQUERQUE ENVIRONMENTAL TOPIC 12:

VISUAL POLLUTION

Background and Problems

The beauty of Albuquerque's natural features is marred for many residents and tourists by two forms of visual pollution: littering, and garish signs and billboards. To combat the growing problem of littering, a City Council Resolution established the Clean Cities Campaign in 1977. Other city action resulted in a Sign Ordinance which sets standards concerning size, number, and types for new commercial signs, and which requires compliance for existing signs by January 1, 1981.

- What are the most effective ways of combatting littering? (New legislation? Stricter enforcement of existing legislation? Massive clean-up drives? Increase the size of the Weed and Litter Control crews; develop programs to promote attitudinal change in the community as a whole?)
- What effect, if any, does the physical appearance of the city have on tourism?
- Does the community have a right to interfere with free enterprise by setting regulations about advertising methods?
- Should businesses be subjected to the expense of replacing existing signs in order to comply with the ordinance by 1981?

Opinions/Options/Possible Solutions

- The lights used along the city's major commercial streets add to the feeling of excitement and urbanity in this, the largest city in New Mexico.
- Based on the principles of free enterprise, businesses have a right to use signs of any shape or size which serve the purpose of competition.
- Small and tastefully-designed signs convey their message better than large, garish ones which when seen *en masse* on a busy commercial street, completely lose their effectiveness.
- The problem of littering must be attacked from many angles simultaneously. Consciousness raising and attitudinal change will be the most effective methods in the long run.
- Visual pollution, if allowed to continue, can have a negative effect on tourism.

Activities

50. Ask students to determine empirically what items make up most of our litter. Collect several bags of litter from a park, shopping center, or the school grounds. Group the contents of the bags into categories selected by the class (cans, bottles, newspapers, candy wrappers). Prepare a histogram to show relative amounts of each category. Repeat this study in several different places or at different times until enough data has been collected to come to some conclusions about the contents of litter. Compare with the students' opinions prior to doing the study. What does the study show about some possible causes of littering?
51. Conduct a rap session in the class on the primary causes of littering.
52. Walk to the supermarket closest to school. Assess the condition of the grounds. If there is considerable litter, try to decide what might have caused it and how this problem could be remedied. Is there a need for more trash receptacles; for more frequent clean-up by the store employees; for a campaign to develop awareness in customers? Devise a procedure for improving the condition of the grounds at the supermarket and bring it to the attention of the store manager. (Be certain that this activity is not undertaken until the school and school grounds are scrupulously clean. "People who live in glass houses, . . .")
53. Working individually or in small groups, design two-dimensional or three-dimensional shopping centers with signs which would be aesthetically pleasing and effective competitively. Compare to signs on one of the city's major commercial arterials or in shopping centers. Which types of signs are most effective in attracting customers?

ALBUQUERQUE ENVIRONMENTAL TOPIC 13:

WATER SUPPLY, CONSERVATION, QUALITY*

Background and Problems

Water, one of the basics of all life, has always played an important part in the history of Albuquerque. It is one of the most broadly-ranging of all the environmental topics with which the city has to cope. Any consideration of water must include such subjects as recharge, arroyos, flood control, use (irrigation, industry, recreation, wildlife, domestic), conservation, wastewater managements, and the areas in which most of these correlate with the basic question of land use. It is an accepted fact that Albuquerque's aquifer, or groundwater supply, is vast and almost unlimited. But, the word "almost" is the clue to what can become a very serious problem to the city by the 21st century if all the components of the closely interwoven water use/land use systems are not wisely blended during the remainder of this century.

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*See also pp. 6, 7, 14–18, 40, 56 72.

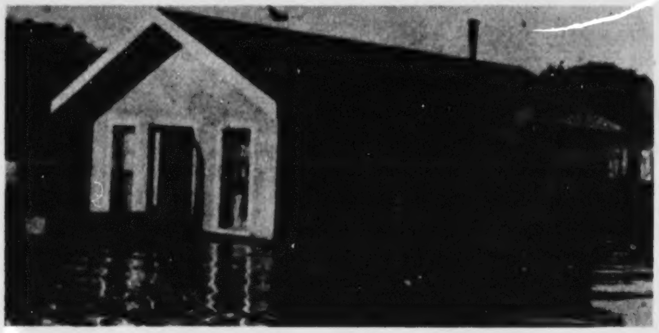
- Do we need to conserve water?
- Should maximum absorption of rainfall be encouraged?
- Should the city acquire additional water rights if necessary to accommodate increasing population needs?
- Will water-use industries be attracted by our "vast" supplies, and, if so, will water be diverted from domestic uses?
- Who has priority for use of water—industry, agriculture, or private citizens for domestic use? How do we influence these decisions?
- What conservation measures could the city take in an emergency?
- Should there be a total systems approach to water as a recyclable resource?
- What water pollutants are a problem in the Albuquerque area?

Opinions/Options/Possible Solutions

- The City sewerage system should be extended to all areas now using on-site systems because they provide greater environmental protection.
- City sewerage systems should not be put into outlying areas because they tend to support high-density land use and may conflict with the Comprehensive Plan's goals for areas designated as rural or semi-rural.
- More water should be diverted from low-yield agricultural use to residential, commercial or industrial uses.
- The public should be educated to native grasses and shrubs which require less irrigation than nonndigenous plants.
- Trees along the Rio Grande should be cleared in order to "salvage" as much water as possible for other purposes.
- The Rio Grande's ecology, its aesthetic value and its potential for passive and active recreation—as well as its use in irrigation—must be considered in all river management programs.
- Any development of arroyos which would inhibit their natural watercarrying and infiltration functions must be prohibited.

Activities

54. Construct a model of a canyon on the west side of the Sandias, a connecting arroyo, and a drainage ditch near the river. Use rocks, sand, and soil to make the model. Plant grass seed or bird seed to simulate vegetation in the appropriate areas. Note what happens when it "rains" (use a watering can) or "snows" (use real snow or crushed ice). How much water runs down through the arroyos to the irrigation ditch? What part does this action play in recharging Albuquerque's water supply? How much water seeps into the earth? Where does this water go, and what becomes of it eventually? What happens when there is a cloudburst? What measures does the city take to provide protection against flooding? How successful are these measures?
55. Use a contour map to determine the size and average slope of a given area on the west side of the Sandias. Contact the City Engineer's office for the formula which will enable students to calculate the amount of water in cu.ft./sec. of flow at a particular place and time. How would different surfaces (developed and undeveloped areas) affect the runoff coefficient? What zoning regulations does the city have to avoid loss of water recharge which could result from development in high slope?
56. Divide the class into two teams. Allow five minutes for them to compile a list of the different ways water is used in Albuquerque. How do the lists compare? As a class, go through the combined list and analyze each item to see which of these uses could be considered needs, and which are wants. Determine also where and how water conservation measures could be used. Write an article for the school newspaper or the PTA Bulletin listing these suggestions.
57. Draw cartoons illustrating wasteful water uses occurring frequently in Albuquerque and a current public issue about sewage disposal, wastewater treatment, flooding, or use of arroyos.
58. Find out from the City Department of Water Resources what the total and per capita consumption of water is in the city at the present time. Based on population projections for the next 25 years, estimate what the total consumption will be then, assuming no changes in lifestyles and comsumption practices. Discuss changes which might increase the use of water. What affect would such increases have on Albuquerque's water supply for the future?
59. Water salvage projects sometimes include plans to remove phreatophytes ("water-consuming" vegetation in the floodplains such as cottonwoods, Russian olive, tamarisk, and willows). Conduct research to find out how much water is used by such vegetation, and how much water could be salvaged by a tree-clearing program. What part does evapotranspiration play? Demonstrate transpiration by putting plastic bags around leaves of floodplain trees, and collecting the transpired water.



APPENDIX:
GLOSSARY

Abiotic: Nonliving factors in the environment; air, water, sunlight, and minerals.

Adaptations: (Biological) Any structural or physiological characteristic that allows an organism to exist under the conditions imposed by its habitat.

Adobe: A brick or building material made of alluvial clay and straw.

Alluvial fan: The fan-shaped area built up by alluvial deposits, usually at the foot of a steep slope as it opens onto a valley floor or plain.

Alluvium: The clay, silt, sand, gravel, or similar material deposited by running water.

Arroyo: A water-carved gully or channel, usually dry.

Barrios: A political subdivision of a city; suburb.

Biodegradable: A material that will decompose quickly as a result of the actions of microorganisms, sunlight, chemical attack, etc.

Biomass: The total quantity of living organisms of one or more species per unit of space at a given time or of all the species in a community.

Biotic: Of or relating to living factors in the environment; plants and animals.

Bosque: A small wooded area abundant with riparian trees and shrubs and usually lining a river bank or floodplain.

Buffering strategy: A plan to protect or buffer oneself from unforeseen factors by providing alternatives.

Carnivore: A meat-eating animal.

Carrying capacity: The amount of living matter an area will support indefinitely.

Clearcutting: A forest management practice of allowing loggers to clear large areas of a forest of all mature trees.

Climax Community: An assemblage of plants which produces conditions favoring its perpetuation, and which will not undergo transition unless disturbed by external forces.

Community: (Biological) An interrelated and interdependent assemblage of plants and animals.

Consumer: (Biological) An organism that obtains vital nutrients and energy by eating other organisms; in the food chain, all organisms other than green plants.

Creoles: People of pure Spanish descent who were born in the Americas.

Cultural: Relating to man and his special ways of reacting to the environment.

Decay: The breakdown of organic matter into simpler compounds due to the digestive action of microorganisms such as bacteria or other decomposers.

Decomposers: The group of organisms in the community that causes decomposition of organic matter, releasing raw materials into the environment.

Demography: The statistical study of human populations especially with reference to size and density, distribution, and vital statistics.

Diversion ditch: A man-made channel that acts to intercept and transport water from one location to another.

Dynamic equilibrium: A state of balance with respect to environmental factors and populations of organisms.

Ecology: The study of the relationship of living things to one another and to their environment.

Ecosystem: The interacting system of a biological community and its nonliving environment.

Encomenderos: A Spanish caste of land and mine owners.

Encomienda System: A system under which the Spanish government gave the rights to Indian labor to colonists.

Energy: The capacity to do work; the capacity of acting.

Environment: The sum of all external conditions and influences affecting the development and survival of an organism.

Erosion: The wearing away of the earth's surfaces by the forces of the atmosphere and gravity.

Escarpment: A steep slope separating two comparatively level or more gently sloping surfaces.

Floodplain: That part of any stream valley which is inundated during floods, or has been.

Food chain: A sequence of organisms in which each uses the next, usually lower, member of the sequence as a food source.

Food pyramid: The quantitative relationship of organisms in a food chain. Thousands of organisms are needed at the bottom of the food chain for the eventual support of one animal at the top, due to energy lost in each conversion.

Food web: A complex pattern of interacting food chains.

Fossil: The solidified imprint or remains of ancient plant and animal life.

Gauchupines: Top level of Spanish caste system; people who had been born in Spain.

Genizaros: A class of people in the Spanish period which served as military personnel.

Geomorphology: The science of the study of land forms; the description and interpretation of the earth's relief features.

Geothermal: Relating to the heat in the earth's interior and the use of steam formed when water comes in contact with this heat.

Greenhouse effect: The heating effect of the atmosphere upon the earth as light waves from the sun pass through the air and are absorbed by the earth. The earth then reradiates this energy as heat waves that are absorbed by the air. The air thus acts as a greenhouse, allowing the passage of light but not heat.

Groundwater runoff: Groundwater, spring, or seepage water, that is discharged into a stream channel.

Habitat: The sum total of environmental conditions that make up the surroundings for an organism or a community.

Herbivore: An organism that feeds on plants exclusively.

Igneous: Rock formed by solidification of molten or once molten material.

Infill: In housing construction, the process of developing open areas within an established area before developing outside the established area.

Interrelationship: The interaction between plants and animals in their environment.

Kiva: A Pueblo Indian ceremonial structure that is usually round and partly underground.

Leibig's Law: The number of individuals in an environment is limited by the amount of the scarcest element necessary to maintain life in that environment.

Life zones: Biogeographical zones that, because of geographic position, temperature, precipitation, elevation, exposure, and history of climates, have restricted or promoted plant and animal similarities.

Limiting factors: The physical needs that determine the survival of a species: temperature, water, air supply, light, food.

Magma: Molten rock material within the earth.

Marsh: A low-lying tract of soft, wet land that provides an important ecosystem for a variety of plant and animal life.

Mestizos: People of mixed Indian, European, and often Negro descent.

Metamorphic: A pronounced change in the constitution of rock effected by pressure, heat, water that results in a more compact and highly crystalline condition.

Niche: The function or position of an organism within the community structure.

Nonrenewable resources: Natural resources that are limited in supply and may eventually be depleted; petroleum, coal, copper, zinc, gold, uranium, etc.

Oxbow: The area resulting from the meandering of a river or stream.

Peneplain: A very late phase of a mature land surface, with very low relief and very gentle slope.

Percolation: Downward flow or infiltration of water through the pores or spaces of rock or soil.

Pioneer plant: The first naturally occuring species of plant to inhabit a newly-established environment caused by burns, floods, or misuse; the first step in ecological succession.

Population: Any group of organisms of the same species that occupies a given space at a particular moment in time.

Predator: An organism that obtains nourishment by killing and consuming other animals.

Primary consumer: An animal that subsists on the producers (plants) for nourishment, usually herbivores.

Producer: An organism that produces its own food from elements in its environment; green plants.

Recycling: Reprocessing for reuse; the process by which waste materials are transformed into raw materials which are then used in new products.

Renewable resources: Natural resources that, through management, treatment, development, or other means, may be restored or replenished; wind, solar, geothermal, hydroelectric, plants, and animals.

Resource Recovery: The process of obtaining raw materials or energy, particularly from solid waste.

Rift: A cracking or splitting of the earth's crust.

Riparian: Relating to or living on the bank of a natural watercourse (stream, river, lake).

Scavenger: An organism that obtains nutrients from dead animals.

Secondary consumer: Animals that feed on the primary consumers; usually carnivores.

Sedimentary: Rock that is formed by continuous deposits of sediment, layer upon layer.

Succession: The gradual, predictable replacement of one community by another. The community itself created the conditions that lead to its replacement by another community. Succession ends with the climax community.

System: An organized interrelationship and interaction of biotic and non-biotic matter with energy.

Temperature Inversion: A state in which cooler, denser air underlies warmer, lighter air and is thus prevented by gravity from vertical mixing and dispersion. Such a condition acts to trap air pollutants near the grounds.

Terrace: A level narrow, plain usually with a steep front resulting from a stream cutting into its broad valley floor.

Topography: The configuration of a surface area including its relief, or relative elevations, and position of its natural and manmade features.

Turbidity: Having the sediment stirred up; murky, dense.

Watershed: Drainage basin, an area of land drained by a given stream.

Uplift: The upheaval or lifting up of the earth's crust.

APPENDIX:
RESOURCE ORGANIZATIONS

The purpose of this compilation is to provide the teacher with the location of local groups, agencies, and persons that will be able to help with environmental concerns. Not all of the listings have free material for the teacher, but all are knowledgeable and concerned with the quality of the Albuquerque environment. It is not a complete list, but rather a beginning. Hopefully, teachers will make additions as they work in environmental education.

In contacting these agencies or individuals, students should remember:

- to call ahead for an appointment
- to keep the appointment as a group if more than one student needs the same information
- to arrive with their own writing materials
- not to arrive with a vague topic and expect the resource person to narrow it down
- not to expect the resource person to do their research for them
- to plan beforehand what questions should be asked to get the information needed
- to allow for the resource person's bias; it is their job to research all sides of an issue
- not to expect the resource person to spend an unreasonable amount of time with them
- to be sensitive to clues that they have used up their time, and, if necessary, make another appointment
- to send the resource person a copy of their report along with a note of thanks

Should students have an opportunity to attend public meetings for the purpose of expressing their opinion and influencing decisions on an issue, remind them:

- to check with office staff ahead of time to find out if it is necessary to register their intent to speak on an issue
- to have their facts organized and use notes when speaking if needed
- to be able to document, where possible, their information
- to deal with issues, not personalities
- to consider the broad impact of a decision, in addition to personal or neighborhood special interests

Albuquerque Archeological Society — P.O. Box 4029, Albuquerque, NM 87106

Albuquerque Center, Inc., 40 First Plaza, Albuquerque, NM 87103

Albuquerque/Bernalillo County Planning Department, P.O. Box 1293, Albuquerque, NM 87103

Albuquerque Gem and Mineral Club, c/o Pete Modreski, 12113 El Dorado Pl, NE, Albuquerque, NM

Albuquerque Historical Society, c/o Margaret Dike, 1611 Bayita Lane, N.W., Albuquerque, NM 87107

Albuquerque Junior Women's Club, c/o Mrs. George Martin, 10305 Chapals Pl. NE, Albuquerque, NM 87111

Albuquerque Urban Observatory, University of New Mexico, Albuquerque, NM 87131

Albuquerque Wildlife Federation, P.O. Box 1234, Albuquerque, NM 87103

All Indian Pueblo Council, 1015 Indian School Rd. NW, Albuquerque, NM 87102

Americans for Rational Energy Alternatives (AREA), P.O. Box 11802, Albuquerque, NM 87112

Animal Control Center, 8920 Lomas Blvd., NE, Albuquerque, NM (Ph. 766-7907)

Boy Scouts of America, 110 Richmond Dr. SE, Albuquerque, NM (Ph. 255-7501)

Bureau of Indian Affairs, Environmental Quality Services, P.O. Box 8327, Albuquerque, NM 87108

Camp Fire Girls, 4101 Silver Ave., SE, Albuquerque, NM

Central New Mexico Audubon Society, P.O. Box 30002, Albuquerque, NM 87110

Clean Cities Campaign, P.O. Box 1293, Albuquerque, NM 87103

Collins, C. K. (resource person in environmental education available Nov.-Apr.) 502 Espanola NE, Albuquerque, NM

Community Development Advisory Board, c/o Community Development Office, City of Albuquerque, 700 Plaza del Sol, Albuquerque, NM

Conservation Action League, P.O. Box 13138, Albuquerque, NM 87112

Denver Public Library, Kay Collins, Librarian, (toll free number for answers to environmental questions, telephone collect [303] 837-5994)

Department of Energy (DOE, formerly ERDA) Sandia Base (ph. 264-0001, Information Officer, ask for Department of Energy.)

Department of Game and Fish, Albuquerque Area, P.O. Box 8346, Station C, Albuquerque, NM

Dietetics Department, Lovelace-Bataan Medical Center, c/o Mrs. B. Draw, 5400 Gibson Blvd. SE, Albuquerque, NM

Energy Resources Board, P.O. Box 2770 Santa Fe, NM 87501

Environmental Improvement Agency (EIA), P.O. Box 2348, Santa Fe, NM 87503

Environmental Planning Commission, P.O. Box 1293, Albuquerque, NM 87103

Environmental Protection Agency, Federal Office Building, 421 Gold Ave., SW, Room 203, Albuquerque, NM 87101

Fish and Wildlife Service, 500 Gold Ave., SE, Albuquerque, NM 87102

Geological Survey Department of the Interior, Federal Building, Cathedral Place, Santa Fe, NM 87105

Girl Scouts of the USA, 609 Fourth Street, NW, Albuquerque, NM (Ph. 243-5581)

Heritage, Conservation and Recreation Service, 5000 Marble NE, Albuquerque, NM 87110

Isaac Walton League of America, c/o Bert Lindsay, 2910 Utah, NE, Albuquerque, NM 87112

Land Use Advisory Council, Legislative Council Service, 334 State Capitol, Sante Fe, NM 87501

Maxwell Museum, University of New Mexico, Albuquerque, NM (Ph. 277-4404) or, Education Division (Ph. 277-2924)

Middle Rio Grande Conservancy District, 1930 Second St., SW, Albuquerque, NM 87101

Museum of Albuquerque, Yale Blvd., SE, Albuquerque, NM (Ph. 766-7878)

NAACP, Albuquerque Branch, c/o Rex V. King, 256 Camino Tres, SW, Albuquerque, NM 87105

National Atomic Museum, Kirtland AFB (Ph 264-8443)

Dairy Council Inc., N.M., 2601 Wyoming, NE, Albuquerque, NM (Ph. 292-1416)

Natural Resource Conservation Commissioner, 321 W. San Francisco, Sante Fe, NM 87501

New Mexico Central Clearing House, 338 E. DeVargas St., Sante Fe, NM 87501

New Mexico Chapter American Nature Study Society, 4300 Sunningdale, NE Albuquerque, NM 87110

New Mexico Chapter-Society of American Foresters, c/o T. J. Loring, 525 Chamiso Lane, NW, Albuquerque, NM 87107

New Mexico Citizens for Clean Air and Water, 135 Harvard SE, Albuquerque, NM

New Mexico Conservation Coordinating Council, P.O. Box 142, Albuquerque, NM 87103

New Mexico Energy Institute, c/o Tom Shishman, University of New Mexico, Albuquerque, NM 87131 (Ph. 277-3661)

New Mexico Farm and Livestock Bureau, c/o Robert Story, 2951 Hyder SE, Albuquerque, NM 87106

New Mexico League of Women Voters, Room 219, 510 Second Street NW, Albuquerque, NM

New Mexico Lung Association, 216 Truman NE, Albuquerque, NM 87108

New Mexico Mountain Club, P.O. Box 4151, Albuquerque, NM 87106

New Mexico State Monument, Coronado Ruins, and Museum, West Bernalillo, Highway 44, Bernalillo, NM (Ph. 867-5351)

New Mexico State Park and Recreation Commission, P.O. Box 1147, Sante Fe, NM 87501

New Mexico State Planning Office, 505 Don Gaspar Ave., Santa Fe, NM 87503

New Mexico State Soil and Water Conservation Committee, 219 State Land Office Building, Santa Fe, NM 87501

New Mexico Wildlife Study Committee, c/o Harriet Collins, 514 13th Street NW, Albuquerque, NM 87102

New Mexico Wildlife Society, P.O. Box 2007, Albuquerque, NM 87103

Old Town Civic Association, Elizabeth Cook, The Roadrunner of Old Town, 2014 Plaza Dr. NW, Albuquerque, NM

Open Space Task Force, c/o Planning Department, P.O. Box 1293, Albuquerque, NM 87103

PIRG-Public Interest Research Group, University of New Mexico, Albuquerque, NM 87131

Public Service Company of New Mexico, c/o Mr. Jerry Geist, 414 Silver Ave., SW, Albuquerque, NM 87102

Rancho De Carnúe, Center for Anthropological Studies, P.O. Box 14576, Albuquerque, NM 87111

Rio Grande Zoological Park, 903 10th Street, Albuquerque, NM 87102

Sandia Mountain Wildlife and Conservation Association, P.O. Box 35, Sandia Park, NM 87047

Sandia Peak Tram Company, No 10 Tramway Loop, Albuquerque, NM 87122

Sierra Club, 1522 Stanford NE, Albuquerque, NM

Sierra Club Office, Central Clearing House, c/o Mr. Brant Calkin, 338 East deVargas, Santa Fe, NM 87501

School of Architecture and Planning, c/o Anne Taylor, University of New Mexico, Albuquerque, NM 87131

Society for Bosque Del Rio Grande Nature Preserve, c/o Harvey Frauenglass, 6839 Guadalupe Trail, NW Albuquerque, NM 87107

Society for Range Management (speakers and youth camp) c/o Mr. LaVelle Thompson, 3124 Carolina NE, Albuquerque, NM 87110 (Ph. 881-0883)

Soil Conservation Service, State Conservation Service, 517 Gold Ave., SW, Albuquerque, NM

Southwest Forest Resources Affairs, Federal Timber Purchasers Association, P.O. Box 14429, Albuquerque, NM 87111

Southwest Research and Information Center, 135 Harvard SE, Albuquerque, NM

State Park and Recreation Commission, P.O. Box 1147, Santa Fe, NM 87503

The Wilderness Society, P.O. Box 38, Glenwood, NM 88039

Trout Unlimited, Rio Grande Chapter, c/o Mathias J. Sagartz, 202 Columbia SE, Albuquerque, NM

United States Fish and Wildlife Service, 500 Gold Ave. SW, Albuquerque, NM (Information, phone 766-3940; Assistant Regional Director for Environment phone 766-2323; Youth programs, phone 766-2606)

United States Forest Service, Regional Office, 517 Gold SW, Albuquerque, NM (recorded program information, phone 24206071)

United States Government Department of Agriculture, Office of the State Conservationist, 517 Gold Ave., SW, Albuquerque, NM

University of New Mexico Mountaineering Club, University of New Mexico, Albuquerque, NM 87131

Urban Development Agency, Suite 700, Plaza del Sol, Albuquerque, NM

West Mesa Mountaineering Club, West Mesa High School, 6701 Fortuna Rd., NW, Albuquerque, NM

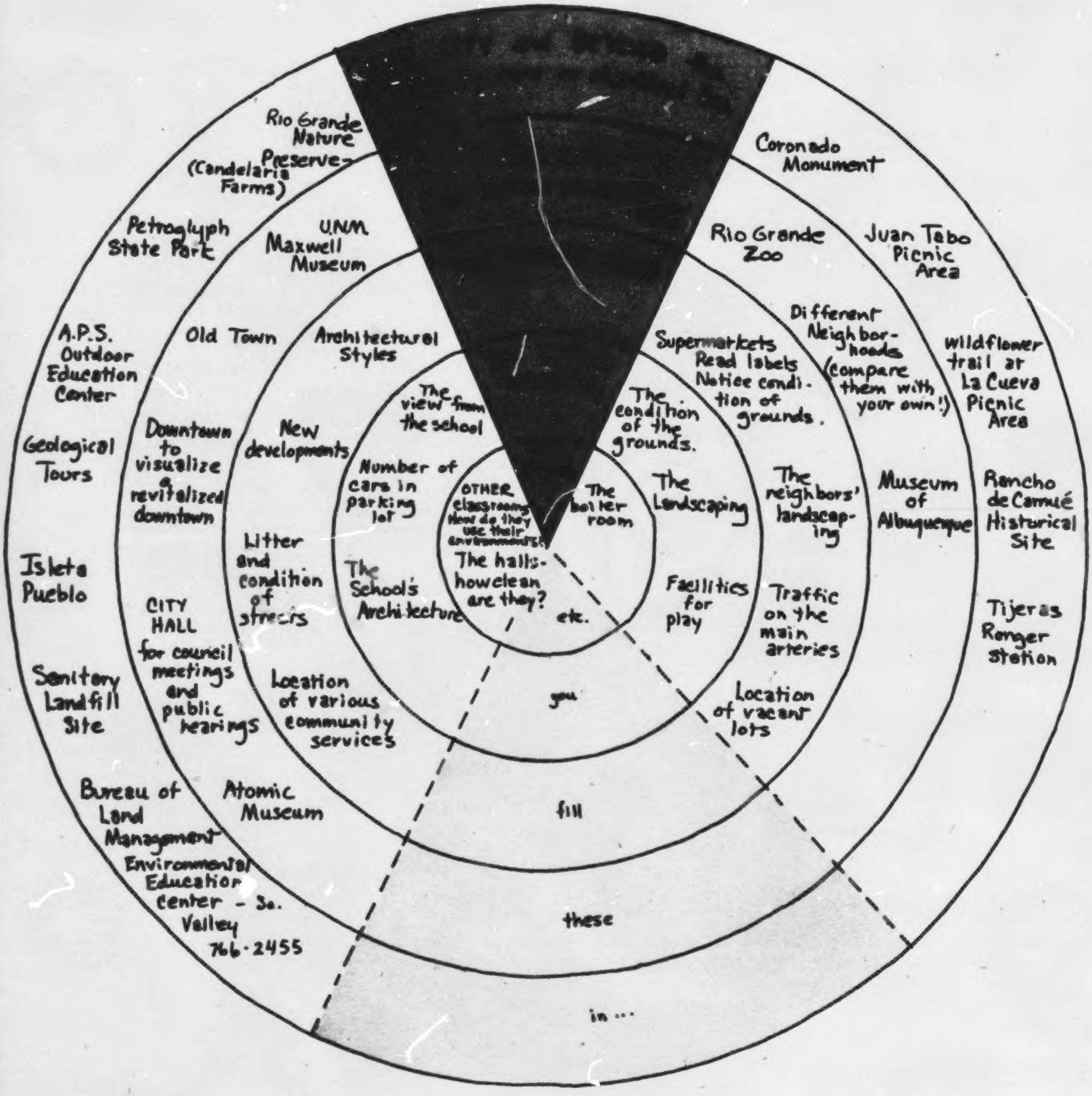
Zero Population Growth, 1408 Sommervill NE, Albuquerque, NM

Topographic maps available from:
Holmans, Inc., 401 Wyoming NE, 87123
United States Geological Survey, P.O. Box 25286, Federal Center, Denver, CO 80225

APPENDIX:

TAKE A TRIP

The best way to study your environment is to GO SEE


OTHER classrooms How do they use their environments?
The halls-how clean are they?
etc.
The boiler room
The view from the school
Number of cars in parking lot
The School's Architecture
The condition of the grounds.
The Landscaping
Facilities for play
Architectural Styles
New developments
Litter and condition of streets
Location of various community services
Supermarkets Read labels Notice condition of grounds.
The neighbors' landscaping
Traffic on the main arteries
Location of vacant lots
U.N.M. Maxwell Museum
Old Town
Downtown to visualize a revitalized downtown
CITY HALL for council meetings and public hearings
Atomic Museum
Rio Grande Zoo
Different Neighborhoods (compare them with your own!)
Museum of Albuquerque
Rio Grande Nature Preserve (Candelaria Farms)
Petroglyph State Park
A.P.S. Outdoor Education Center
Geological Tours
Isleta Pueblo
Sanitary Landfill Site
Bureau of Land Management
Environmental Education Center - So. Valley 766-2455
Coronado Monument
Juan Tabo Picnic Area
Wildflower trail at La Cueva Picnic Area
Rancho de Carnué Historical Site
Tijeras Ranger station
you
fill
these
in...

APPENDIX:
SOME ORGANIZATIONAL SYSTEMS FOR STUDYING THE ENVIRONMENT

The term environment means "everything around us," obviously, an overhwelmingly large body of knowledge. In an attempt to cope with such a comprehensive topic, various environmental educators have developed organizational systems which enable teachers and students to perceive relationships and integrate their findings. Several of these schematics or categorizing methods have been drawn upon in the preparation of this book. All have strengths and weaknesses. Use of any one of them is a matter of individual preference. Several are described below.

STRANDS — The National Environmental Education Development Program, National Park System

- **Variety and Similarities.** A variety of functions, sizes, and structures exist in plants, and stars, rocks and animals, processes and people. Yet there are sufficient similarities to permit their classification into orderly patterns.
- **Patterns.** Organizational patterns . . . may be found in rock formations as well as in social groups of animals or people. Functional patterns include traffic movement and classroom schedules. Spatial arrangements are patterns that often please us.
- **Interaction and Interdependence.** Nothing exists in isolation. Each individual is constantly interacting with living and nonliving things. The process is continuous as part of the life cycle.
- **Continuity and Change.** Both living and nonliving things are constantly changing. Some things remain the same in spite of change. Matter and energy may change in form but they can never be created or destroyed.
- **Evolution and Adaptation.** Over centuries and centuries of time, organisms alter and develop in the process called evolution. Probably the greatest number of changes over the longest period of time come about in order to enable an organism to adapt to the environment.

UNIVERSAL THEMES OF MAN

- Cycles of life (propagation, birth, growth, maturity, death)
- Phenomena of change
- Man's use of the land
- Man's use of natural resources
- Effects on matter of liquid, heat, pressure, friction, and catalyst
- Technology and invention
- Expressive activities of man

A SYSTEMS VIEW OF THE ENVIRONMENT (Center for Curriculum Design P.O. Box 350 Evanston, IL 60204)

- An environment is a field of fields within fields
- A field is BIST/QUANTA
- Which are structured in CODES
- Which are integrated in systems
- Which are coordinated in NETWORKS
- All of which are harmonized by RHYTHMS
- There is a whole field, which embodies all other fields, and which all other fields embody
- The whole field does the same thing
- But each field does it differently

THE A/B/C INTERACTION OF THE TOTAL ENVIRONMENT

An environment is composed of
Abiotic, Biotic, and Cultural factors which interact.

TETE — Total Education-Total Environment
William R. Eblen, P.O. Box 113
Wilton, CT 06897

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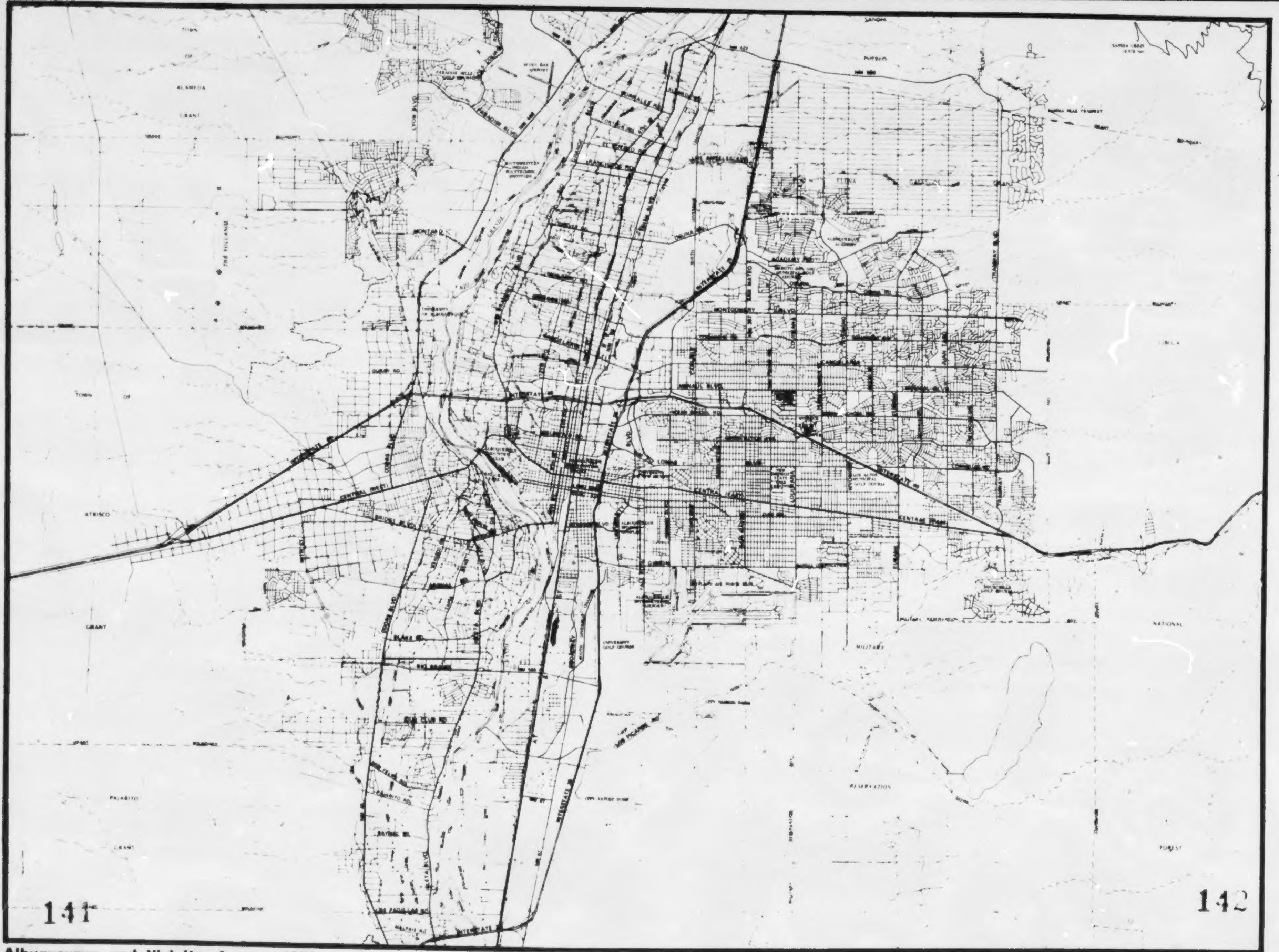
TOWN OF ALAMEDA GRANT
SANDIA PUEBLO
TOWN OF ATRISCO GRANT
PAJARITO GRANT
MILITARY RESERVATION
NATIONAL FOREST
MONTGOMERY BLVD
CENTRAL AVE
INTERSTATE 40
INTERSTATE 25
COORS BLVD
ISLETA BLVD
UNIVERSITY GOLF COURSE

Albuquerque and Vicinity January, 1976

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